# Chapter 3
# Affected Environment

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## 3.1 Introduction

This chapter describes the environment in which the fisheries and the federal action occur for Southeast Alaska, the Pacific Coast, and the Columbia River basin. The status of listed and unlisted salmonid species is discussed, as well as the status of other fishes, seabird, marine mammal populations (both listed and unlisted), and lower trophic level species. Particular emphasis is given to the life histories and migration patterns of salmonids that may be encountered in the fisheries.

Because harvest management actions are interrelated (i.e., salmonid runs migrate among regions), this chapter begins with an overview of salmon migration patterns, with particular reference to fishery encounters of listed ESUs. Following this overview are general descriptions of the physical, biological, and human environment for each management region.

## 3.2 Salmonid Migration Patterns and Vulnerability of Listed ESUs to Fisheries

Designated salmon and steelhead ESUs and their ESA listing status are shown in Table 1.3.1. Vulnerability of salmon and steelhead stocks to fisheries considered in this FPEIS depends, in part, on the timing and route of migration. Migration patterns of mature salmon are most important, but juvenile chinook and coho are also encountered and killed in the fisheries. In general, salmon migrate within 20 miles of shore, which, historically, has increased their vulnerability to anglers and smaller commercial troll operations who operate close to the coastline.[1] Some

[1] The number of years spent at sea depends on species and stock. Both coho and pink salmon typically spend only one winter at sea. Sockeye (2 to 3 years), chum (2 to 4 years) and steelhead (less than 1 to 3 years) spend fewer winters at sea compared to chinook (2 to 5 years).

of the listed chinook ESUs and all of the coho ESUs are vulnerable to ocean fisheries off the Pacific Coast. Figures 3.2-1 through 3.2-7 show ESUs for individual species. Historic harvest rates and the distribution of harvest for key chinook and coho ESUs are shown in Figure 3.2-8. This figure shows, for example, that Oregon coastal coho were generally subject to low harvest rates off British Columbia, but were subject to high harvest rates both north and south of Cape Blanco. Puget Sound chinook were subject to low harvest rates off Southeast Alaska, high harvest rates off British Columbia, and moderate harvest rates in the area north of Cape Blanco. These harvest patterns generally reflect the distribution and timing of the fish relative to existing fisheries.

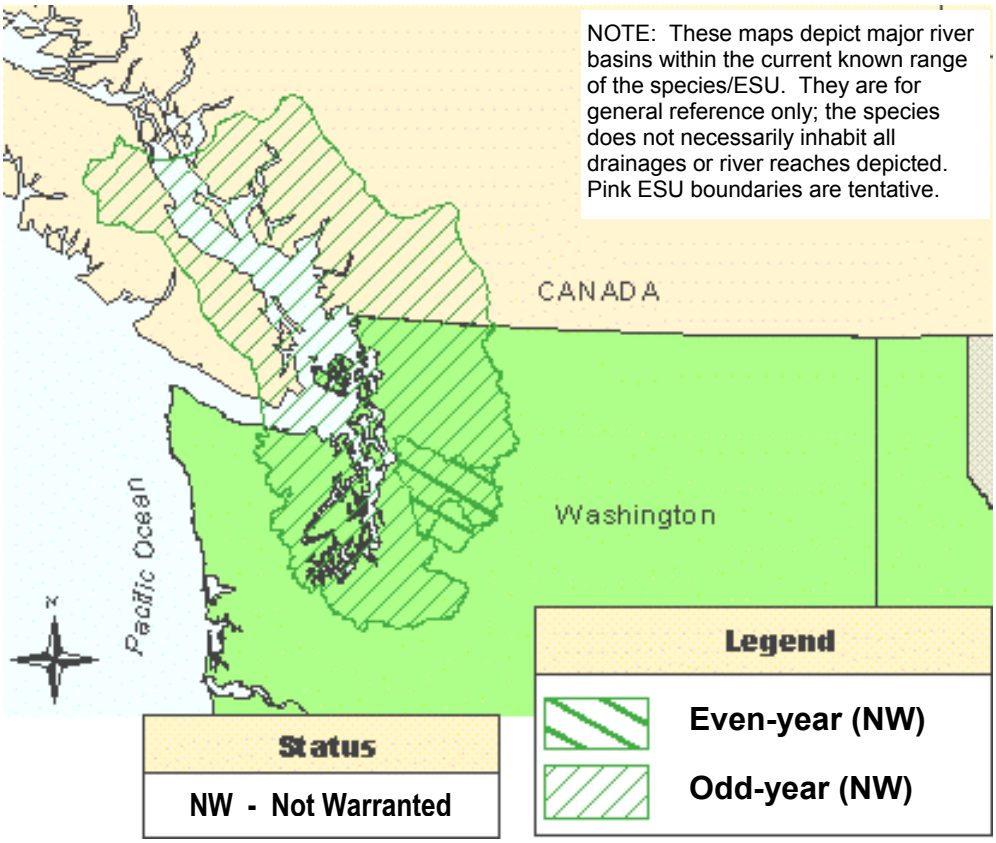



**Figure 3.2-1.** Pink salmon ESU status map.

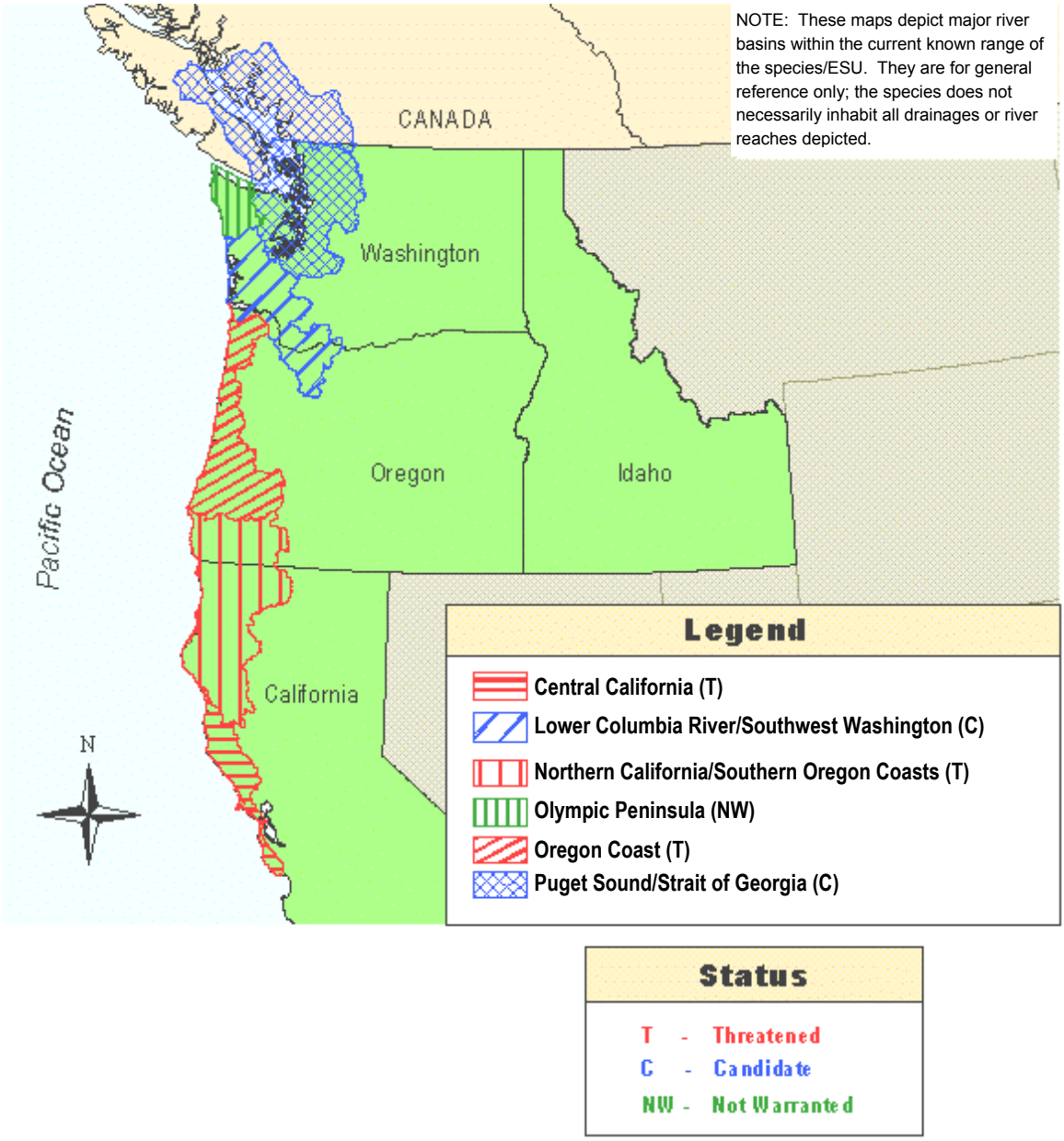



**Figure 3.2-2.** Coho salmon ESU status map.

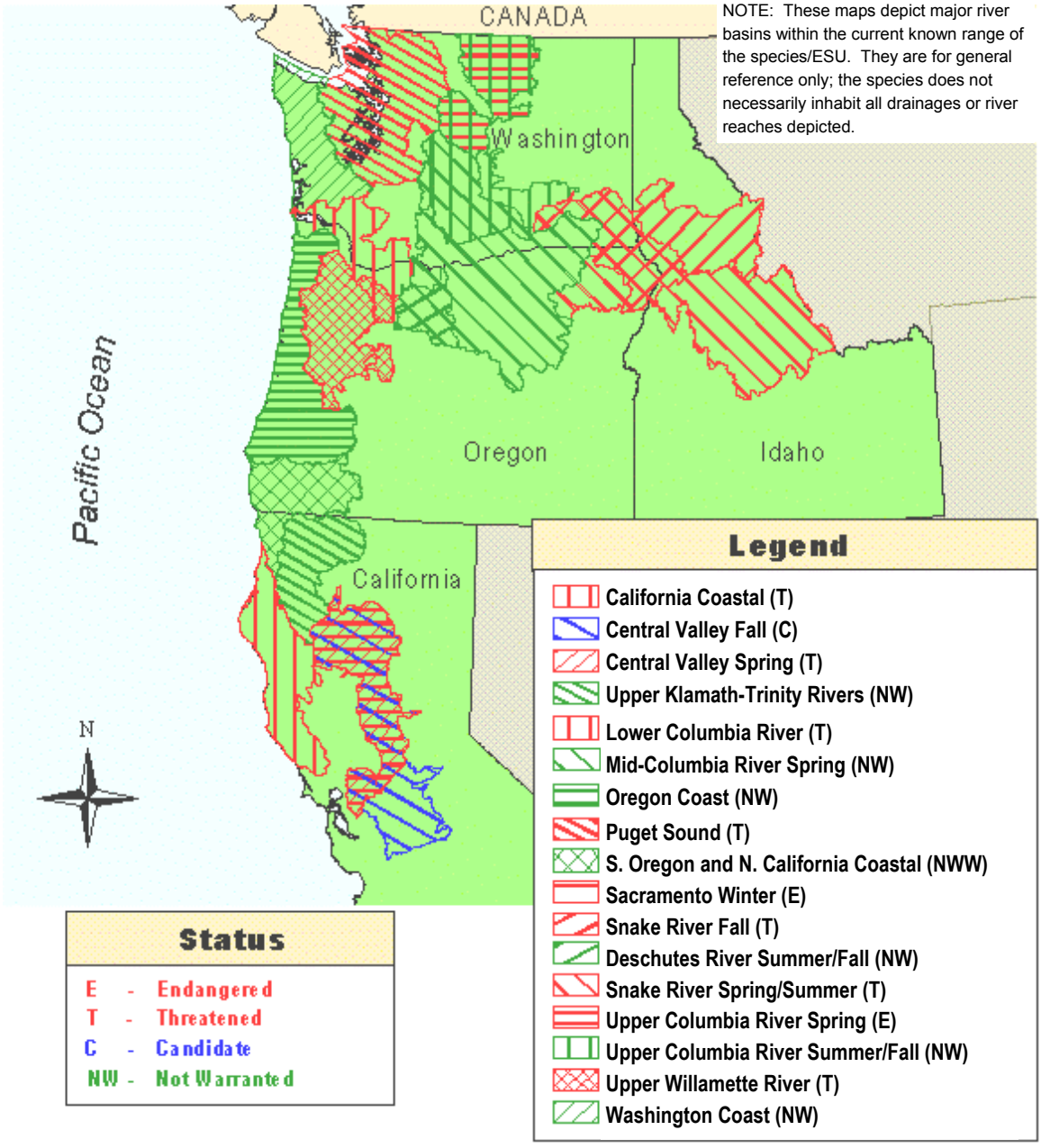



**Figure 3.2-3.** Chinook salmon ESU status map.

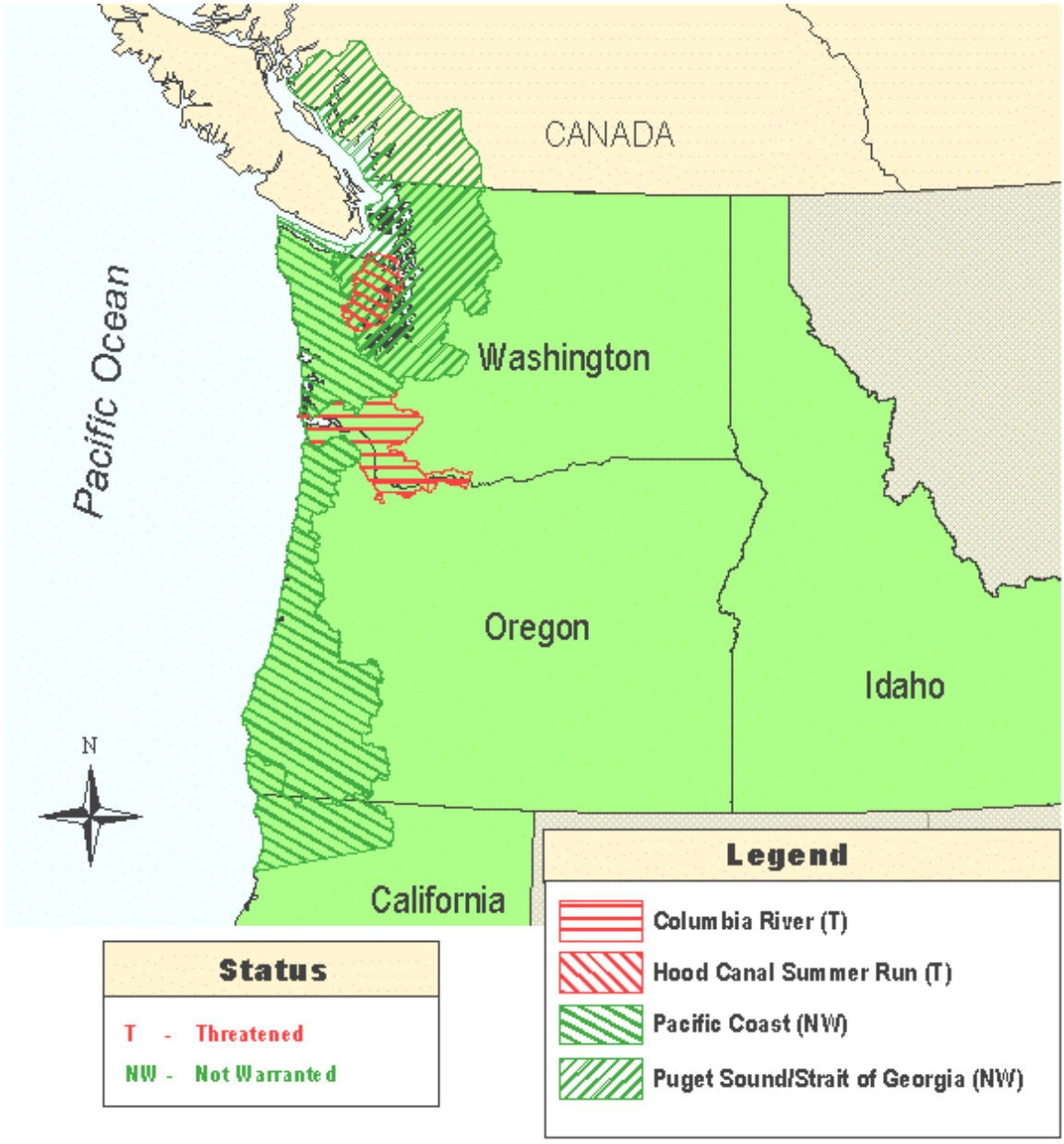



**Figure 3.2-4.** Chum salmon ESU status map.

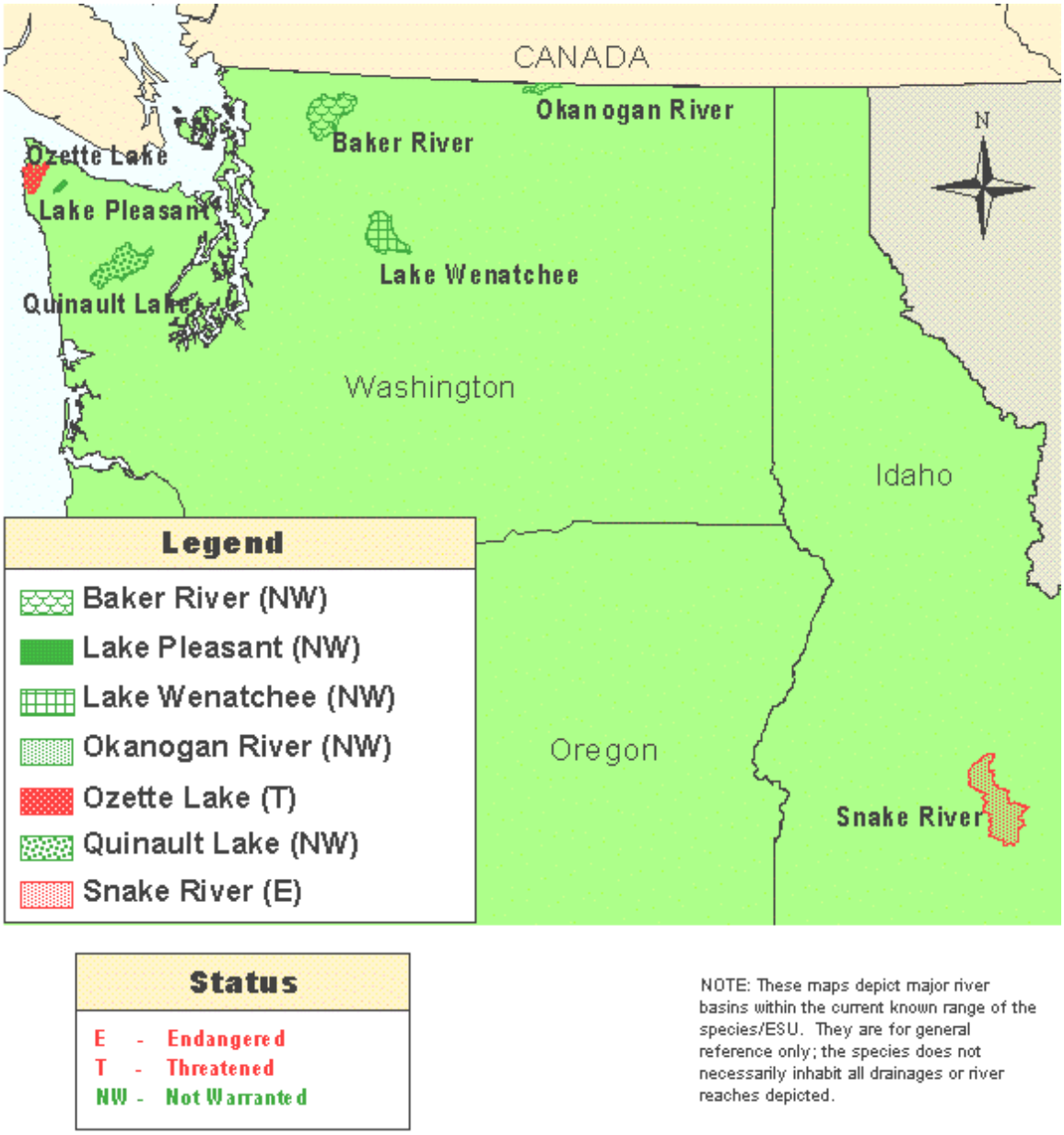



**Figure 3.2-5.** Sockeye salmon ESU status map.


**Figure 3.2-6.** Steelhead ESU status map.

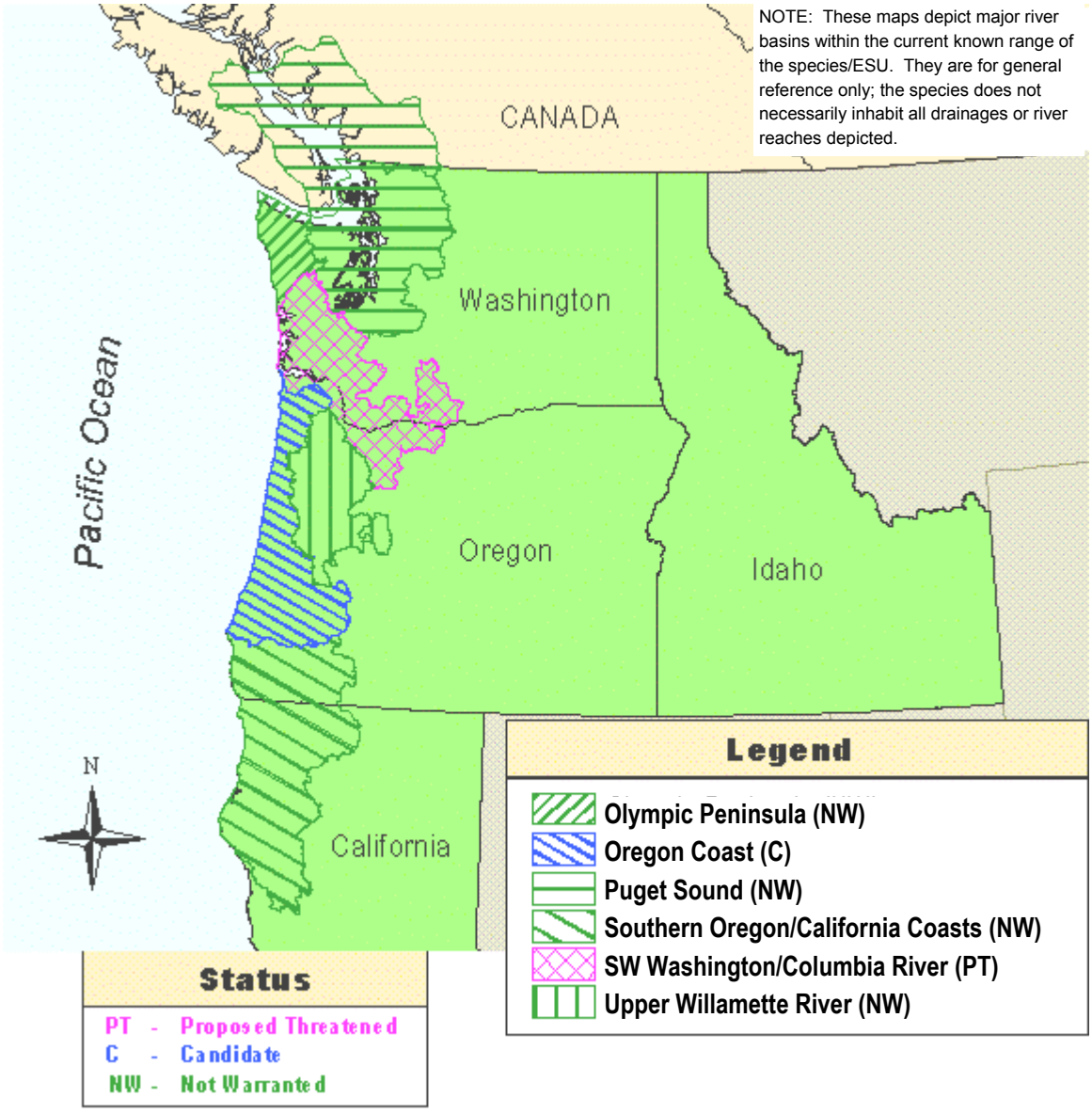
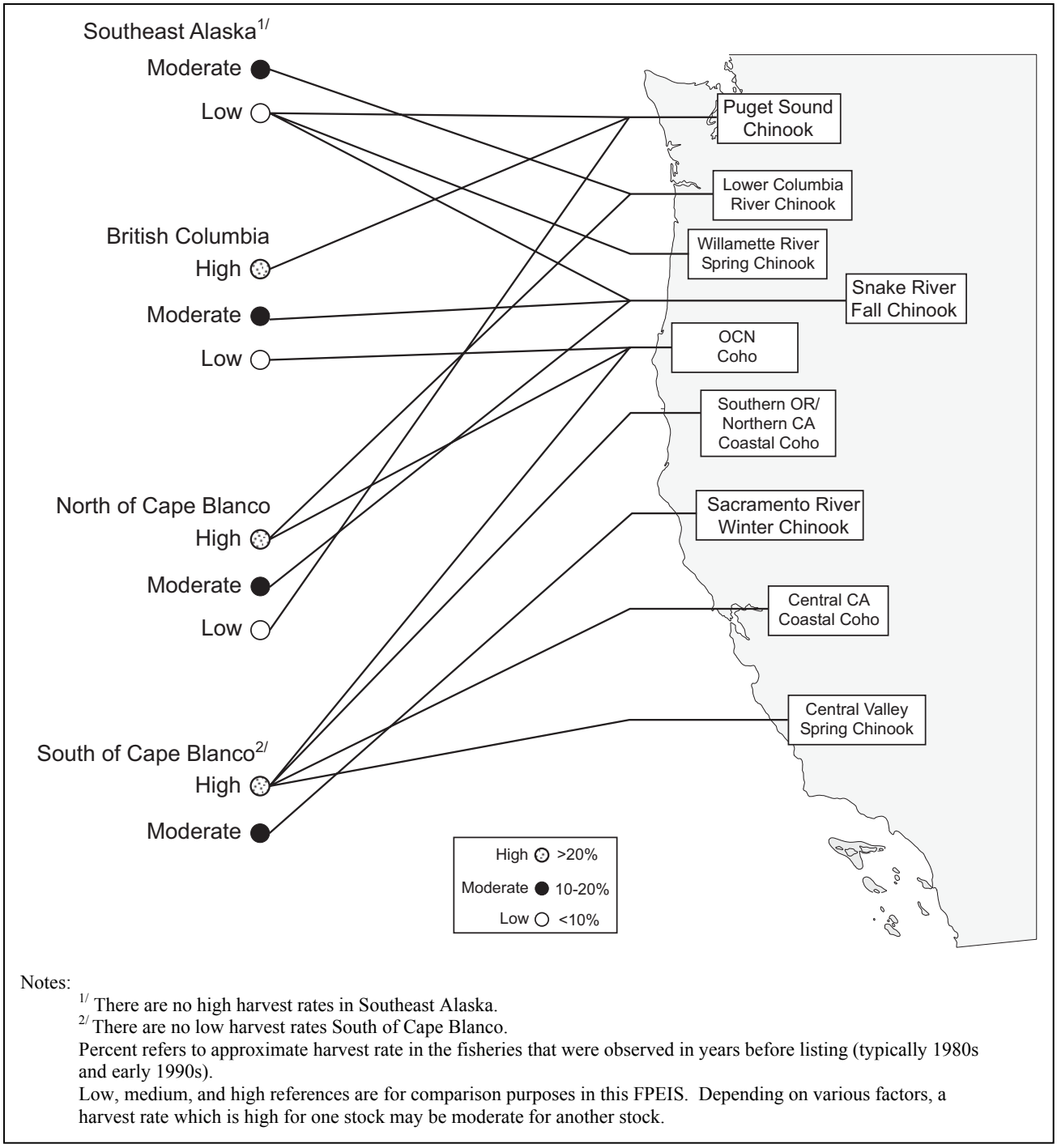



**Figure 3.2-7.** Coastal cutthroat trout ESU status map.




Notes:
1/ There are no high harvest rates in Southeast Alaska.
2/ There are no low harvest rates South of Cape Blanco.
Percent refers to approximate harvest rate in the fisheries that were observed in years before listing (typically 1980s and early 1990s).
Low, medium, and high references are for comparison purposes in this FPEIS. Depending on various factors, a harvest rate which is high for one stock may be moderate for another stock.

**Figure 3.2-8.** Historic harvest rates for listed chinook and coho ESUs in ocean fisheries.

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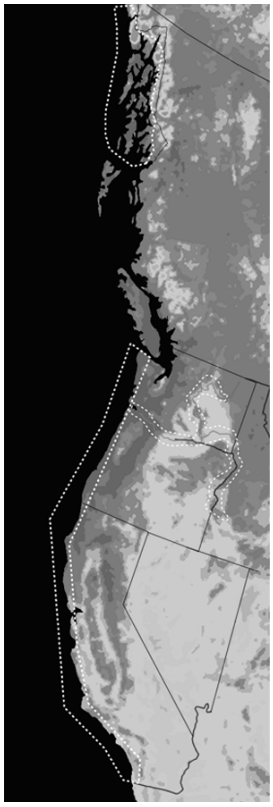
## 3.3 Southeast Alaska



The following sections describe the physical, biological, and human environments in Southeast Alaska, under the jurisdiction of NPFMC. As stated in Chapter 1, NPFMC has conditionally deferred management authority for the salmon fishery in the EEZ off Southeast Alaska to the State of Alaska.

### 3.3.1 Physical Environment

The Southeast Alaska management area includes all marine and estuarine waters between Dixon Entrance and Cape Suckling, from the upper high-tide line to 200 miles from the westernmost landmass. The region, approximately 150 miles wide and 450 miles long, consists of seven major and hundreds of minor islands making up the Alexander Archipelago, which lies adjacent to the Coast Mountain range separating Alaska from Canada. A labyrinth of deep fjords, inlets, and passages, the Alexander Archipelago has thousands of miles of marine shoreline. The terrestrial environment consists of North America's largest icefields and coastal low-elevation rain forest. Most of the terrestrial area is within the Tongass National Forest, which contains approximately 42,500 miles of streams and 20,200 lakes and ponds, totaling 260,000 acres. In the streams, 12,200 miles of anadromous fish habitat exists (Forest Service 1991). Most of these streams are relatively small and short.

Precipitation at sea level in Southeast Alaska ranges from 27 inches per year at Skagway to 220 inches per year at Little Port Walter. The average annual precipitation has been estimated to be as high as 400 inches on the southern end of Baranof Island and approximately 260 inches over the Juneau icefield. Southeast Alaska has complete cloud cover about 85 percent of the year. Snowfall varies according to elevation and distance inland from the coast. The Pacific maritime influence holds the daily and seasonal temperatures within a narrow range. Winter temperatures range from 20 to 40 degrees Fahrenheit (°F), but may decrease when skies clear. Summer temperatures are generally in the mid-60s and may extend into the 70s; about every other year, temperatures rise into the 80s (National Weather Service Juneau 1984).

Water depth in the southeastern part of the Gulf of Alaska ranges from zero feet at the high tide line to 650 feet in the inside waters and drops to 6,500 feet just beyond the continental shelf. In general, the inside waters are more protected from ocean swell, wind, and storm disturbance. Open ocean conditions prevail west of the islands and in the wider channels between islands. Tidal range is up to 20 feet, varying by latitude and location. Currents offshore are northerly along a continental shelf that is less than 60 miles wide (Hood and Zimmerman 1987). Extensive input of freshwater from glacial and non-glacial rivers reduce the salinity of the marine waters within Southeast Alaska. Most of the glacial rivers are located on the mainland and have their origins in the Coast Range. The Taku and Stikine rivers, the largest of the mainland rivers, have glacial origins in Canada. Glacial streams carry large sediment loads into marine waters but the non-glacial streams usually do not.

Southeast Alaska remains relatively pristine, although some areas have been extensively logged. Primary land use activities beyond the boundaries of villages and small cities are logging and mining. Few industries operate in Southeast Alaska and water quality is high. The main potential threats of chemical pollutants are from petroleum product spills, sewage outfalls, and logging and mining operations.

## 3.3.2 Biological Environment

### 3.3.2.1 Salmonid Species

Wild runs of chinook, coho, sockeye, pink, and chum salmon in Southeast Alaska were at historically high levels in the 1980s and 1990s (Rogers 1987, Wertheimer 1997).[2] Spawning escapements of all species were stable or increasing in 99 percent of the management units and 93 percent of the spawning aggregates, indicating nearly all species and stocks were healthy. Escapement levels for five drainages that intersect Alaska and Canada (transboundary rivers) have steadily increased since the 1970s and have reached the escapement objectives in recent years (PSC 1999a).

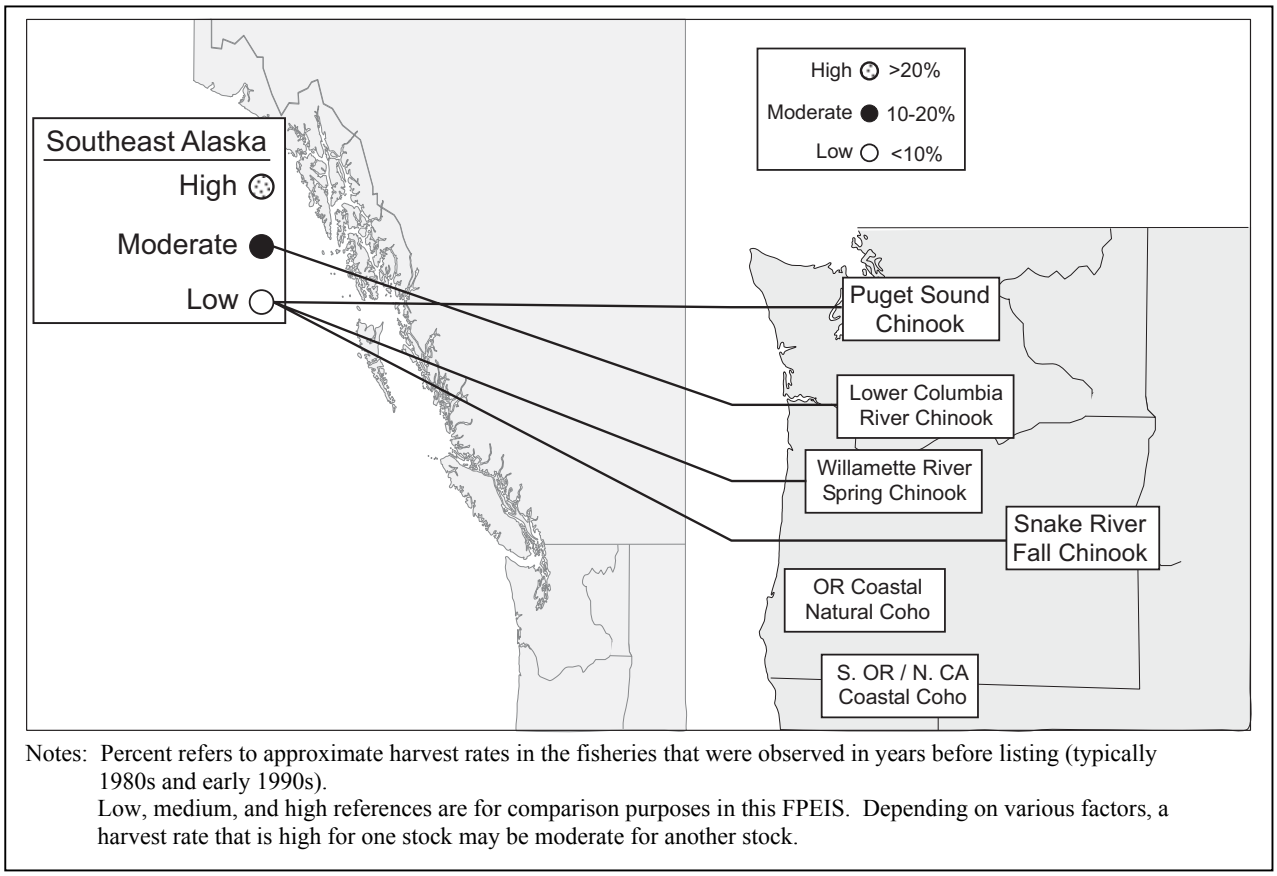
The commercial troll and recreational salmon fisheries in Southeast Alaska target primarily chinook and coho salmon, whereas commercial purse seine and gillnet fisheries target pink sockeye and chum salmon. Primary stocks contributing to the Southeast Alaska chinook harvests were British Columbia stocks (50 percent), southern United States stocks (30 percent), and Alaskan stocks (20 percent) (Dave Gaudet, ADF&G, personal communication). Listed chinook stocks represent a very small percentage of the harvest. Nearly all coho salmon harvested in Southeast Alaska originate from Alaskan streams (Weitkamp et al. 1995).

Slaney et al. (1996) classified the status of chinook stocks originating in British Columbia and Yukon as unthreatened, special concern, or extinct. Of the 407 stocks that could be classified, 81 percent were not threatened and 15 percent were classified as a special concern or at risk. Columbia River upriver bright chinook, Middle Columbia River bright chinook, and north-migrating Oregon coastal chinook represent a significant portion of the Alaska harvest and are stable.

### 3.3.2.2 ESA Listed Salmonids

No salmon or steelhead stocks originating from Alaskan streams are listed for protection under the ESA. Listed salmon ESUs incidentally harvested in Southeast Alaska include Snake River fall chinook, Willamette River spring chinook, Puget Sound chinook, and lower Columbia River chinook (Figure 3.2-1). Some of the chinook stocks included in the Lower Columbia River ESU are subject to moderate harvest rates in the Southeast Alaska fishery. Puget Sound and Willamette and Snake River chinook are subject to low harvest rates. The Alaska fisheries have little or no effect on listed coho ESUs. Hood Canal summer chum salmon are not taken in Southeast Alaska fisheries (NMFS 2000a). Other listed salmon and

[2] Baker et al. (1996) evaluated the status of salmon and steelhead stocks in Southeast Alaska by examining spawning escapement trends within management units and spawning aggregations when 10 or more years of data were available. Sufficient data were not available for 8.5 percent of the management units and 90 percent of the spawning aggregates, but data were available for 50 percent of the chinook spawning aggregates.




Notes: Percent refers to approximate harvest rates in the fisheries that were observed in years before listing (typically 1980s and early 1990s).
Low, medium, and high references are for comparison purposes in this FPEIS. Depending on various factors, a harvest rate that is high for one stock may be moderate for another stock.

**Figure 3.3-1.** Historic harvest rates for listed chinook and coho ESUs in Southeast Alaska fisheries.

steelhead stocks are not likely to be encountered by Southeast Alaska troll and recreational fisheries (NMFS 1996).

### 3.3.2.3 Non-Salmonid Fish Species

Species other than salmon are occasionally taken in the Southeast Alaska troll and sport fisheries including Pacific halibut, flounders, skates, steelhead, Dolly Varden char, sablefish, cod, greenlings, rockfish, and sculpins. In the commercial troll fishery, Pacific halibut, rockfish, and sablefish may be retained and sold under the individual fishing quota (IFQ) program. Occasional catches of rockfish, steelhead, Dolly Varden char, and cod may be retained for personal consumption. Unwanted harvest is unhooked and returned to the sea; most fish are released alive (NMFS 1997a).

### 3.3.2.4 Listed and Unlisted Mammalian Species

Population information on listed and unlisted mammals inhabiting Southeast Alaska, the Pacific Coast, and the Columbia River basin is summarized in Table 3.3-1. Because fishery interactions with these species are rare, more detailed information is given in Appendix B.

**Table 3.3-1.** Status of unlisted marine mammal species known to inhabit the Southeast Alaska, Pacific Coast, or Columbia River basin fishery management areas.

| Species | Area Present | Population Status |
|---|---|---|
| Northern Fur Seal (*Callorhinus ursinus*) | Pacific Coast, Southeast Alaska, possibly Columbia River | Approximately 1 million animals for all areas. Eastern N. Pacific stock (Alaska) depleted. |
| Pacific Harbor Seals (*Phoea vitulina richardsi*) | Pacific Coast, Southeast Alaska, Columbia River | Approximately 57,000 animals for Pacific Coast. West Coast population increasing. Gulf of Alaska stocks depleted relative to 1970s and 1980s. |
| California Sea lion (*Zalophus californians*) | Pacific Coast | 160,00-180,000 animals. Population increasing rapidly. |
| Northern Elephant Seal (*Mirounga angustirostris*) | Pacific Coast | 84,000 animals. Population stable. |
| Dall's Porpoise (*Phocoenoides dalli*) | Pacific Coast, Southeast Alaska | West Coast population ≤ 417,000. No reliable information on trends. |
| Harbor Porpoise (*P. phocoena*) | Pacific Coast, Southeast Alaska | 43,000 animals for West Coast, 30,000 in Alaska. No reliable information on trends. |
| Pacific White-Sided Dolphin | Pacific Coast, Southeast Alaska | ≤ 931,000 animals all areas; 122,000 for West Coast. No information on trends. |
| Bottlenose Dolphin (*Tursiops truncates)* | Pacific Coast | < 3,000 animals for West Coast. No information on trends. |
| Northern Right Whale Dolphin (*Lissodelphis borealis*) | Pacific Coast | 21,000 animals for West Coast. No information on trends. |
| Risso's Dolphin (*Grampus griseus*) | Pacific Coast | 32,000 animals for West Coast. No information on trends. |
| Striped Dolphin (*Stenella coeruleoalba*) | Pacific Coast | 25,000 animals for West Coast. No information on trends. |
| Short-Beaked Common Dolphin (*Delphinus delphis*) | Pacific Coast | 372,000 for West Coast. Populations increasing. |
| Long-beaked common Dolphin (*D. capensis*) | Pacific Coast | 9,000 animals in California. No information on trends. |
| Baird's Beaked Whale (*Berardius bairdii*) | Pacific Coast, Southeast Alaska | West Coast stock 250 animals. No trend estimate. |
| Cuvier's Beaked Whale (*Ziphius Cavirostris*) | Pacific Coast, Southeast Alaska | West Coast population ≥ 9,000. No trend estimate. |
| Mesoplodont Beaked Whales (*Mesoplodon spnoilal.*) | Pacific Coast, Southeast Alaska | Approximately 2,000 animals. No trend estimate. |
| Gray Whale (*Eschrichtius robustus*) | Pacific Coast, Southeast Alaska | Population approx. 23,000 for E. Pacific. Increasing 3% annually. |
| Killer Whale (*Orinus orca*) | Pacific Coast, Southeast Alaska | 600 animals in Alaska, 840 for West Coast. No trend estimate. |
| Minke Whale (*B. acutorostrata*) | Pacific Coast, Southeast Alaska | No estimates on population except California (200 animals) |
| Short-Finned Pilot Whale (*Globicephala macrorhynchus*) | Pacific Coast | West Coast population 1,000. No trend estimate. |
| Pygmy Sperm Whale (*Kogia breviceps*) | Pacific Coast | West Coast population ≥ 3,000. No trend estimate. |
| Dwarf Sperm Whale (*K. simus*) | Pacific Coast | No population estimates. |

Note: West Coast includes Pacific Coast and Southeast Alaska populations.

#### 3.3.2.5 Listed and Unlisted Avian Species

Population information on listed and unlisted avian species inhabiting Southeast Alaska, the Pacific Coast, and the Columbia River basin are discussed in Appendix B. Seabirds are plentiful in Alaska, owing to the productive marine waters and abundant nesting habitat. Approximately 50 million seabirds of 38 species nest in more than 1,600 colonies. Up to 50 million shearwaters and three albatross species feed in Alaskan waters but breed elsewhere. Seabirds nest on steep seacoasts or remote islands and spend up to 80 percent of their lives at sea. Food is obtained at sea by picking prey from the surface or by diving and pursuing it underwater.

Some seabird populations in the Bering Sea, Aleutian Islands, and Gulf of Alaska regions have declined during part or all of the past two decades (Hatch and Piatt 1995, NRC 1996b). Seabird population trends are largely determined by forage fish availability (Birkhead and Furness 1985). The most serious non-food threat to seabird populations in Alaska has been (and remains) the historical introduction of alien predators, including foxes (Bailey 1993) and rats (Loy 1993).

#### 3.3.2.6 Lower Trophic Level Species (Forage Fishes)

Forage species perform a critical role in the complex ecosystem by providing the transfer of energy from the primary or secondary producers to higher trophic levels. Many species undergo large, seemingly unexplainable fluctuations in abundance.[3] Squids, euphausiids, amphipods, and small schooling fish are important prey for salmonids in Southeast Alaska. Research indicates juvenile salmonids feed opportunistically upon the available mix of prey items (Pearcy 1998).[4] Of the salmon forage species in Southeast Alaska, only Pacific herring (*Clupea harengus*) has a directed fishery. Some evidence exists that osmerid abundance, particularly capelin and eulachon, has declined significantly in Alaska since the mid-1970s.[5]

### 3.3.3 Human Environment

This section describes the human environment in which the fisheries and the federal action occur. Included are a brief description of how commercial and recreational fisheries are managed, the characteristics of the commercial and recreational fishing fleets and associated industry, the demographic and economic characteristics of the communities where these fisheries are centered, and the socioeconomic importance of the fisheries to these communities.

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[3] Most of these species, including herring, anchovy, sardine, smelt, capelin, and sand lance, have high reproductive rates, are short-lived, attain sexual maturity at young ages, and have fast individual growth rates (e.g., herring, anchovy, sardines, smelt, capelin, and sand lance). These biological characteristics make the species more susceptible and responsive to seasonal, interannual, and decadal shifts in oceanographic conditions within the ecosystem.

[4] Young coho and chinook occur in the shelf zone in summer-autumn and consume small fish and squid (Gorbatenko 1989). Pink salmon move to deep sea areas as juveniles and feed on plankton, then return to the shelf waters in summer as pre-spawning adults to feed on small fish and squid (Gorbatenko 1989).

[5] Evidence for this comes from marine mammal food habits data from the Gulf of Alaska (Calkins and Goodwin 1988), as well as from data collected in biological surveys of the Gulf of Alaska (not designed to sample capelin) (Anderson et al. 1994) and commercial fishery bycatch from the eastern Bering Sea (Fritz et al. 1993). It is not known, however, whether smelt abundance has declined or whether the populations have redistributed vertically, due presumably to warming surface waters in the region beginning in the late 1970s. Yang (1993) documented considerable consumption of capelin by arrowtooth flounder, a demersal lower-water column feeder, in the Gulf of Alaska, which also indicates redistribution.

### 3.3.3.1 Fishery Management

As discussed in Chapter 1, the Alaska salmon fishery occurs in the EEZ waters and in State waters off the coast of Southeast Alaska. The EEZ waters (from 3 to 200 nautical miles) are divided into the west and east sections, divided at the longitude of Cape Suckling (Figure 3.3-2). The west area is closed to all commercial salmon fishing (with three minor exceptions for traditional coastal net fishery) but commercial fishing is allowed in the east area. Sport fishing is allowed in both areas. State waters include those east of the western archipelago and those within 3 nautical miles of the western coast of this archipelago.

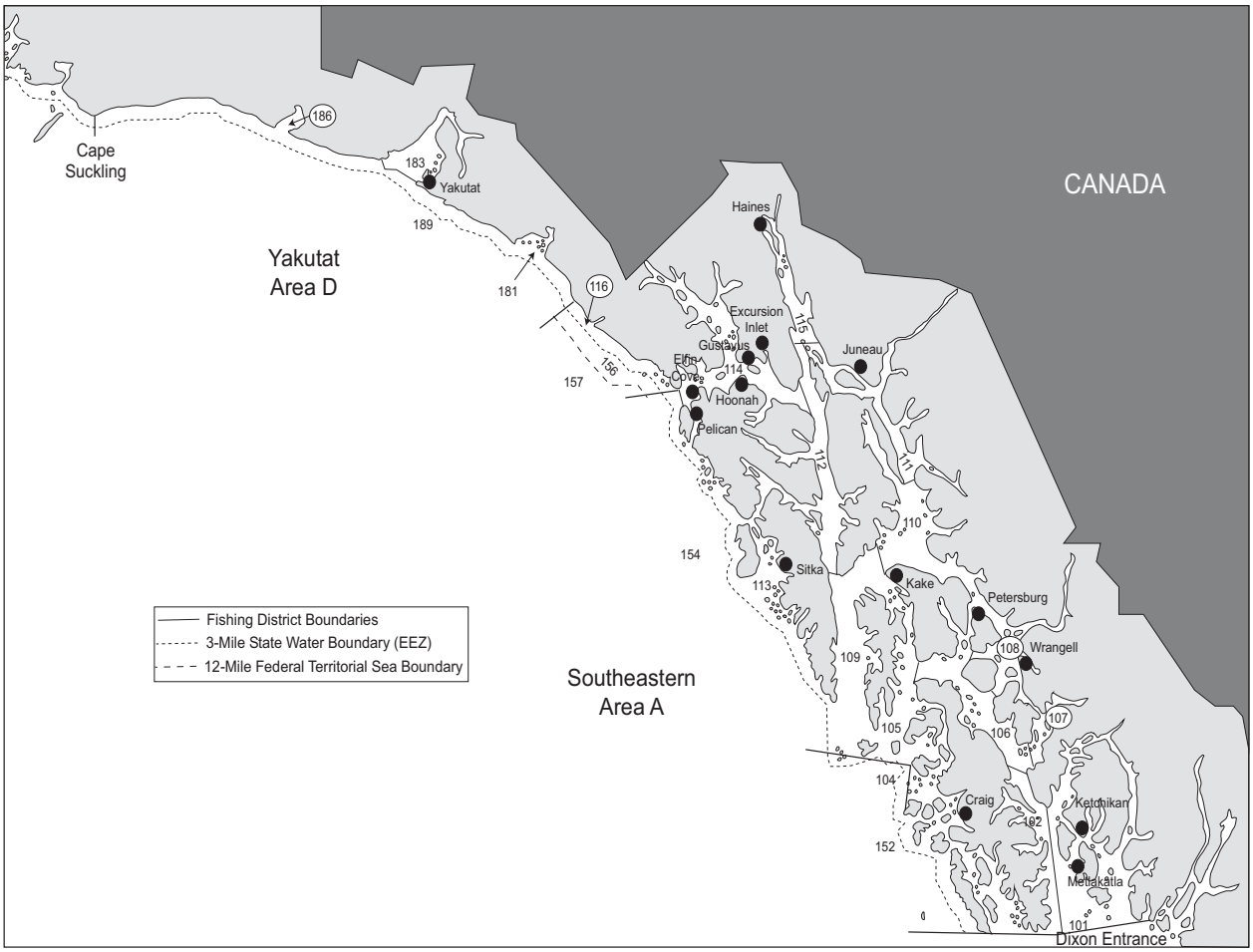



**Figure 3.3-2.** Southeast Alaska commercial salmon fishing areas and districts.

ADF&G manages the Southeast Alaska salmon fishery in state waters, where most of the chinook fishery occurs, and in the federal waters of the EEZ. Under the North Pacific Fishery Management Council (NPFMC) FMP, NMFS' director of the Alaska Region reviews ADF&G management plans annually to ensure consistency with the FMP, the Magnuson-Stevens Act, and the Pacific Salmon Treaty and reports findings to the NPFMC. The NPFMC retains the option of specifying management measures applicable to the EEZ that differ from those of the State if it determines the ADF&G proposed actions are inconsistent with the Magnuson-Stevens Act or other federal law. To date, the NPFMC has never exercised that option, and has consistently deferred management of the commercial troll and

recreational salmon fisheries in the EEZ off the coast of Alaska to the ADF&G (ADF&G 1997).

The Southeast Alaska fishery includes commercial, recreational, subsistence, and personal use salmon fisheries harvesting sockeye, chum, coho, pink, and chinook salmon. In general, harvest of salmon species, except chinook, has increased since the early 1970s. During this time, salmon spawning escapements have either increased or have no predominant trend, therefore indicating that the current harvest levels do not represent over-exploitation (NMFS 1997a).

#### 3.3.3.2 Commercial Fisheries and Harvests

Commercial use of Southeast Alaska salmon resources began in the late 1870s. Until the early 1900s, sockeye salmon was the primary species harvested (ADF&G 1996). Pink salmon began to dominate the harvest in the early 1900s and, in recent years, has comprised 75 to 90 percent of the region's salmon harvest. Salmon harvest rates in Southeast Alaska peaked in the late 1930s and early 1940s but declined to historically low levels in the 1950s and early 1960s. During the mid- to late 1960s catches increased, but in the early 1970s production declined again. Since the mid-1970s, salmon production levels in the region have been increasing with record catches of pink and chum (1996), coho (1994), and sockeye salmon (1993) occurring in recent years (Sands and Koenings 1997a).

Gear-specific fishing permits are required for all Southeast Alaska commercial fisheries. Gear types include troll, drift gillnet, set gillnet, and purse seine nets. Only troll gear is allowed in EEZ waters. Salmon permits are "limited entry" permits and must be obtained by transfer from a current permit holder. There are separate permit types for power trollers (boats that operate their lines via hydraulic systems) and hand trollers, whose lines are operated by hand-powered gurdies. There are approximately 955 power troll and 1,500 hand troll permits. Approximately 90 percent of the power-troll permits and less than half the hand-troll permits are active in any given year (NMFS 2000a).

Approximately 6 percent of the chinook and coho harvest occurs in the EEZ. Before 1980, the troll fishery harvested about 85 to 90 percent of the chinook taken in Southeast Alaska. In 1992, the Alaska Board of Fisheries adopted new regulations that effectively limit the troll fleet to approximately 68 percent of the overall Southeast Alaska chinook salmon harvest (the actual percentage depends on the overall quota). Since 1980 this overall harvest of chinook salmon in Southeast Alaska has decreased because of harvest ceilings imposed as part of the Pacific-Salmon Treaty coastwide rebuilding program and to address other conservation measures.

As discussed in Chapter 4, two recent periods (1988 to 1993 and 1994 to 1997) are used as baselines to estimate the effects of the proposed alternatives given varying abundance levels of salmon. From 1988 to 1993 (Baseline 1), the average troll harvest of salmon was approximately 2.9 million fish valued at $27.6 million, compared to a harvest of 52.2 million fish valued at $106.9 million dollars for all gear types in Southeast Alaska. From 1994 to 1997 (Baseline 2), the average troll harvest totaled approximately 3.4 million fish valued at $22.7 million dollars, compared to an all-gear harvest of 68.3 million fish valued at $90.7 million dollars. For Baseline 1, trollers harvested 238,000 chinook, 1.6 million coho, 16,000 sockeye, 143,000 chum, and 844,000 pink salmon. For Baseline 2, troll catches

totaled 178,000 chinook, 2.1 million coho, 25,000 sockeye, 332,000 chum, and 754,000 pink salmon (Figures 3.3-3 and 3.3-4).

Drift gillnet, set gillnet, and purse seine fishers operate only in state waters. In general, net fisheries target pink, sockeye, and chum salmon while taking substantial numbers of coho and lower numbers of chinook. Purse seines, which harvest primarily pink salmon, take 70 to 90 percent of the Southeast Alaska commercial salmon harvest.

#### 3.3.3.3 Seafood Processors

Seafood processors provide market outlets for the commercial harvest of salmon and are the leading manufacturers in Alaska. In 1995, Alaska's 197 seafood processing plants accounted for approximately 64 percent of all manufacturing employment in the State; no other state in the United States approaches this level of industrial concentration. Seafood processing provides an average of 11,000 jobs with a total payroll of more than $240 million, and peak seasonal employment is considerably higher.[6]

By 1989, the volume of groundfish processed at seafood processing plants throughout the State surpassed salmon production for the first time. During the past decade, employment in the processing industry grew much more rapidly than overall employment in the State. Although seafood processing facilities are located in many communities throughout Southeast Alaska, most processing plants are concentrated in Petersburg and the Ketchikan Gateway Borough area (National Oceanic and Atmospheric Administration [NOAA] 1999). Total employment in seafood processing in Southeast Alaska was estimated at 1,750 average annual equivalent jobs in 1994 (Hartman 1999).

#### 3.3.3.4 Consumers of Salmon

Consumption of salmon has increased worldwide over the last 18 years. Per capita consumption in the United States in 1996 was 3.65 times that in 1979 while the U.S. population increased 18 percent. Most of the increased demand is for fresh and frozen as opposed to canned salmon (Council 1999a). In 1997, the United States went from being a net exporter of fresh and frozen salmon to a net importer. The United States is a net exporter of fresh and frozen coho and a net importer of fresh and frozen chinook. The main market for Southeast Alaska salmon is domestic with some chinook going to Europe. In the context of increasing consumption, wholesale and ex-vessel prices have remained depressed because of the increase in imports of farm-raised salmon.

#### 3.3.3.5 Commercial Fishery Economic Value

The economic value of the commercial salmon fishery can be measured in terms of its monetary value to producers and consumers. Producers include the commercial fishers, including operators (or permit holders), crew members, and fish processors. Consumers include the public that consumes salmon. Revenues received by the commercial fishers for their harvest represent gross economic value (commonly referred to as the ex-vessel value) because it is the amount commercial fishers receive for their product after it leaves the

[6] These numbers exclude most of the factory trawler fleet and other offshore processing vessels because much of their employment occurs outside the State's jurisdiction.

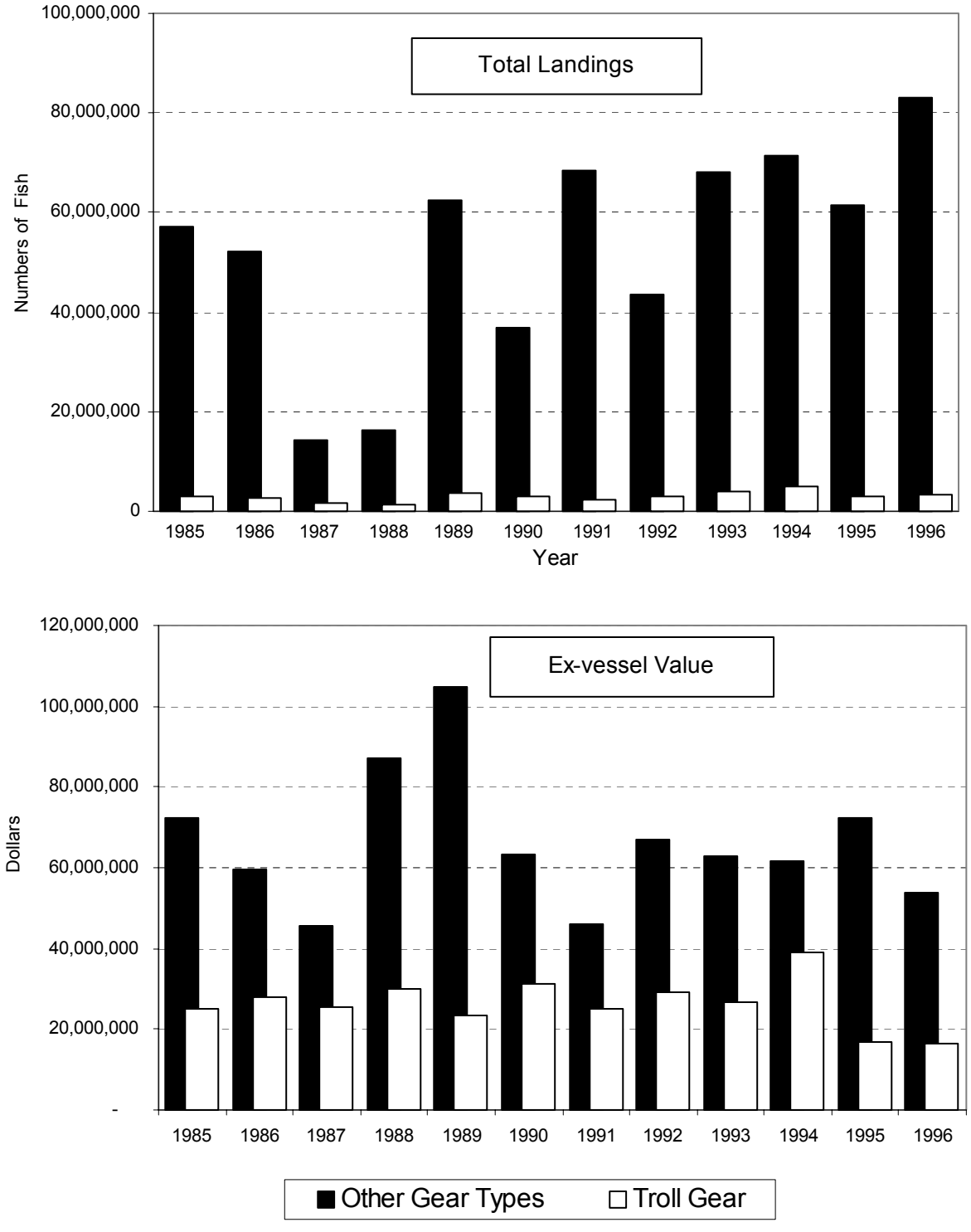



**Figure 3.3-3.** Southeast Alaska salmon harvest and value by troll and all other gear types (1985 to 1996).

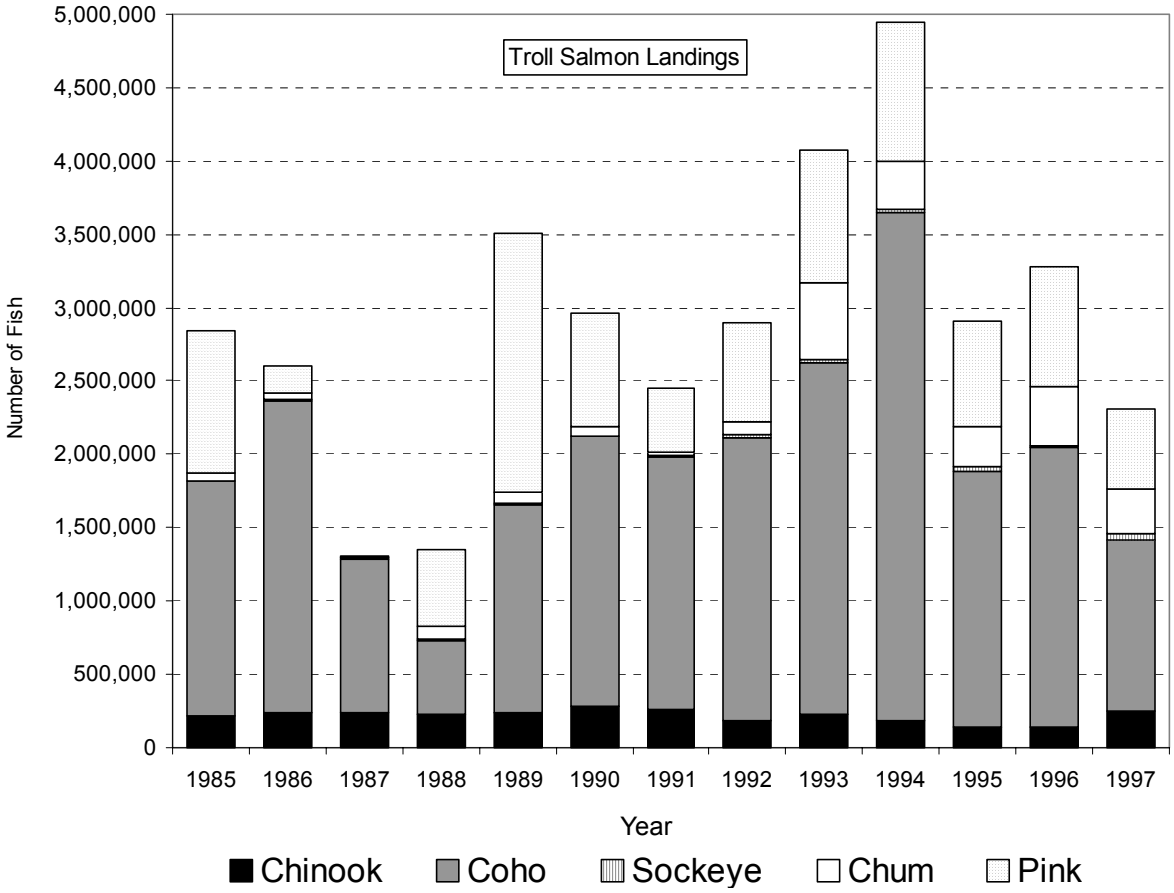



**Figure 3.3-4.** Southeast Alaska troll harvest by species (1985 to 1996).

fishing vessel. Net economic value is the amount of total revenues received by the vessel operators less the costs of production including wages, operational expenses such as fuel and equipment, and fixed costs such as insurance and depreciation. Net economic values are the appropriate measure for cost-benefit analysis.

It is important to note that the concept of economic cost is not the same as accounting or budgetary cost. Economic costs are measured by the lost opportunity of using resources (e.g., labor or capital) in alternative ways. For example, labor used to harvest salmon could be used in many ways, but using this labor to harvest salmon means it is not available for alternative uses elsewhere. Consequently, the use of labor for harvesting salmon "costs" the nation an opportunity to do something else with these resources (assuming there are alternative uses for them).

As shown in Figure 3.3-3, the ex-vessel value of the commercial salmon harvest in Southeast Alaska in 1996 was approximately $70 million (this ex-vessel value was the lowest over the last 12 years). Based on an average net income coefficient of 0.426 derived from an economic study by the Institute of Social and Economic Research (ISER) in 1996, the net income to vessel operators fishing for salmon in Southeast Alaska is estimated at

$30.0 million. For the troll fleet, the ex-vessel value is approximately $14 million, and the net income is estimated at $6 million, approximately 20 percent of the regionwide totals.

In addition to the net income that the commercial salmon fishery generates for permit holders, the fishery also generates wages and fringe benefits for crew members. As identified in the ISER study, wages and fringe benefits to crew members fishing for sockeye salmon in the Kenai Peninsula account for approximately 14 percent of the ex-vessel value. Applying this percentage to the 1996 ex-vessel value of $70.4 million, crew members received an estimated $9.9 million in wages and fringe benefits. According to the ISER study, crew members (as well as permit holders) also benefit from higher than normal levels of job satisfaction. If crew members accept lower wages because of the non-monetary benefits they receive beyond what they are paid, then vessel operators also benefit because crew members are working for less than what they would be paid in other, less desirable jobs.

In addition to commercial fishers (permit holders and crew members), the commercial salmon fishery also generates economic value for seafood processors. Based on information for the Cook Inlet sockeye commercial fishery in the 1996 ISER study, processing increases the price paid for sockeye salmon by approximately 65 percent. Because of the limited availability of cost data, no information is provided in the ISER study that quantifies the net income received by processors. The benefit of the Southeast Alaska salmon harvest to consumers is represented by the difference between what consumers are willing to pay for the salmon versus what they actually pay (i.e., consumer surplus).

#### 3.3.3.6 Recreational Salmon Fisheries and Harvests

In 1996, approximately 70 (80,000) percent of Southeast Alaska anglers were nonresidents and 30 percent (34,000) were residents. Of the 509,000 angler days fished in 1996 (Figure 3.3-5), nonresident anglers fished approximately 246,000 days and resident anglers fished 263,000 days. According to Jones & Stokes Associates (1991), approximately 48 percent of trips made by nonresident anglers in Southeast Alaska target salmon, with nearly 80 percent of these targeting chinook. Recreational anglers in Southeast Alaska fish for salmon with rods and lines and must obtain a license to fish.

In 1997, 30 percent of the saltwater angling effort occurred in Juneau, 24 percent in Sitka, 17 percent in Ketchikan, 10 percent in Prince of Wales Island, and 9 percent in the Kake/Petersburg/Wrangell/Stikine area. Sitka led all other port areas with 47 percent of the chinook harvest and 27 percent of the coho harvest.

During the 1980s, approximately 40 percent of sport fishing activity for resident anglers occurred in Juneau, followed by Sitka (18 percent), Ketchikan (17 percent), and the Kake/Petersburg/Wrangell/Stikine area (10 percent). Approximately 58 percent of trips made by resident anglers targeted salmon with more than half (57 percent) of these targeting chinook. For nonresident anglers, 26 percent of sport fishing activity occurred in Ketchikan, followed by the Kake/Petersburg/Wrangell/Stikine area (15 percent), Juneau (13 percent), and Prince of Wales Island (12 percent). Although more recent estimates are not available, it is likely that Sitka now leads other port areas in nonresident angler effort. More than 40 percent of all sport fishing trips made by resident anglers in Southeast Alaska occur in July and August (Jones & Stokes Associates, 1991). Total resident and nonresident recreational effort (i.e., number of trips) from 1988 to 1996 is shown in Figure 3.3-6.

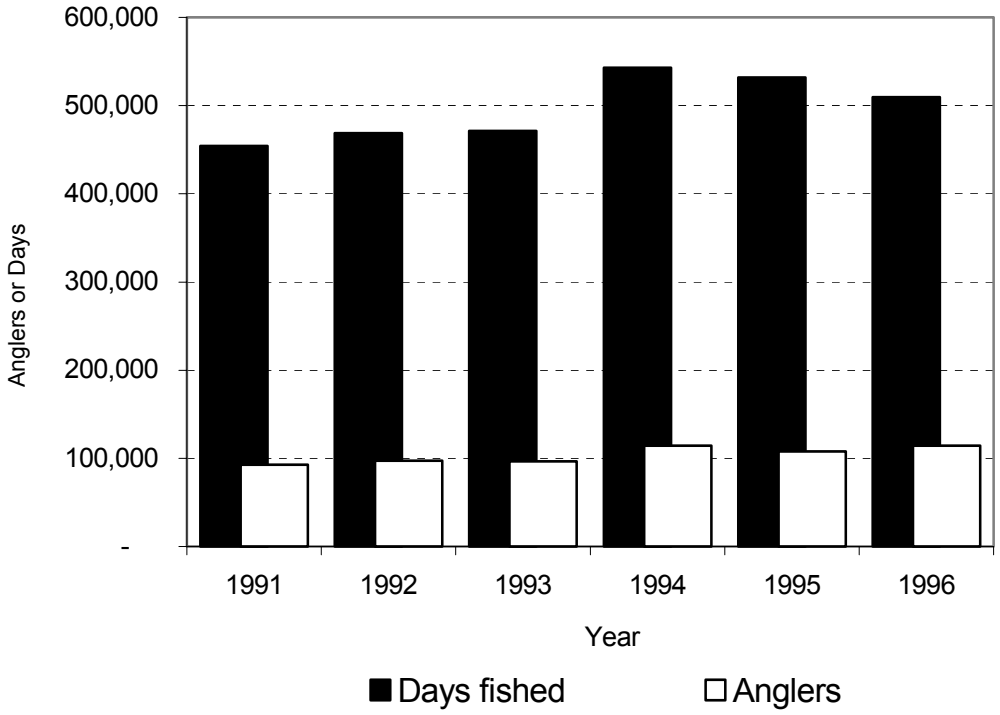



**Figure 3.3-5.** Number of anglers and days fished in Southeast Alaska (1991 to 1996).

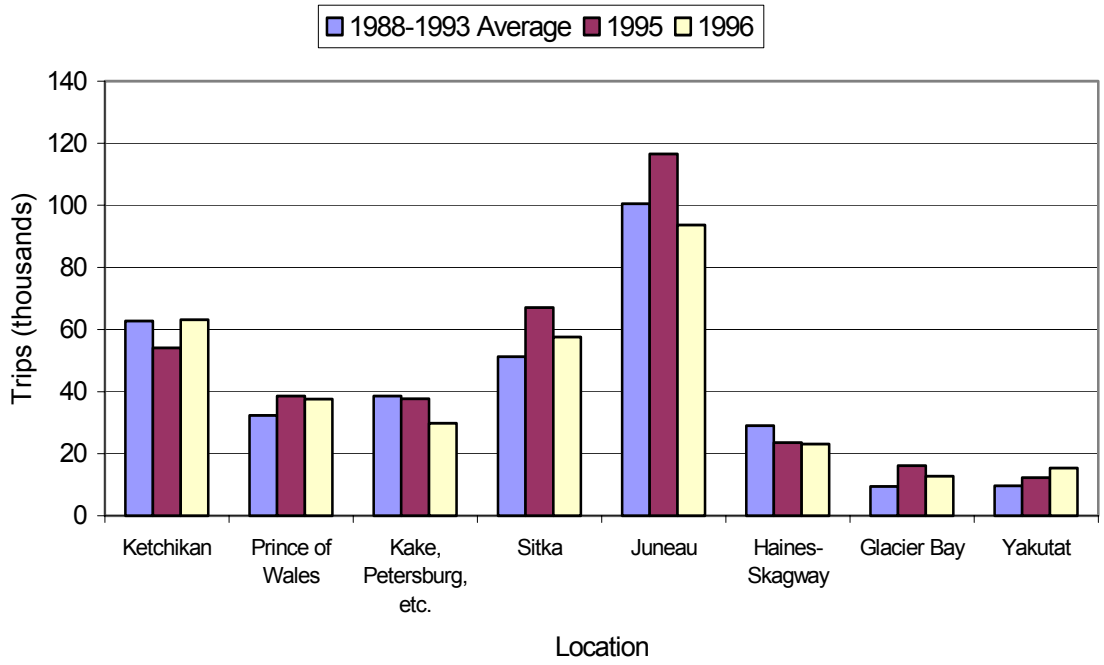



**Figure 3.3-6.** Number of trips by area in Southeast Alaska.

**Sport Harvest and Effort Trends**

Although chinook are the preferred harvest of most marine salmon anglers in Southeast Alaska, 36 percent of the sport harvest is pink salmon, 35 percent coho, and 15 percent chinook, with chum and sockeye making up the remainder.

The average annual sport harvest of salmon in Southeast Alaska was 187,000 from 1988 to 1993 and 257,000 from 1994 to 1997. The average annual sport effort was 273,000 trips from 1988 to 1993 and 299,000 trips from 1994 to 1997. The sport harvest of chinook averaged 43,000 and the coho harvest averaged 85,000 from 1988 to 1993 compared to the annual chinook average of 49,000 and the coho average of 139,000 from 1994 to 1997. From 1991 to 1996, the number of anglers in Southeast Alaska ranged from 93,000 to 114,000 (Figure 3.3-5); at a minimum, 60 percent of the anglers were nonresidents. From 1986 to 1994, the total number of angler trips ranged from 293,000 (1986) to 384,000 (1994). There were 334,500 trips in 1996 (Jones and Stokes 1991).

**Other Sport-Fishing-Related Businesses**

Other businesses affected by sport fishing for salmon include lodging (hotels/motels and fishing lodges/camps), food and beverage establishments, transportation services, marine stores (boats and accessories), bait and tackle stores, general sporting goods stores, service stations, and miscellaneous retail trade stores. In 1988, sport fishing-related sales in Southeast Alaska were an estimated $56.3 million (excluding resident angler spending for food and beverages) and supported 1,700 jobs. Resident anglers accounted for 61 percent ($34.6 million) of expenditures and nonresident anglers accounted for 39 percent ($21.7 million) (Jones & Stokes Associates 1991).

Salmon anglers, particularly nonresidents, frequently employ guides. More than 60 percent of guiding activities are based in Juneau, Ketchikan, and Sitka (Jones & Stokes Associates 1991). An estimated $6.4 million was spent by anglers on sport fishing guide services in Southeast Alaska in 1988, and more than 95 percent of spending was by nonresident anglers who spent as part of package fishing trips (Jones & Stokes Associates 1991). The peak months for sport fishing guiding activities are June, July, and August; very little or no guide activity occurs from November through March.

### 3.3.3.7 Sport Fishery Economic Value

Similar to the commercial salmon fishery, the economic value of the recreational salmon fishery in Southeast Alaska can be measured by the value it generates for consumers and producers. Consumers include sport anglers who engage in salmon fishing, both in coastal waters and inriver. Producers are those businesses that provide goods and services to anglers participating in salmon sport fishing including guides, charter boat operators, and other businesses such as bait and tackles stores, lodging, food and beverage establishments, and miscellaneous retail stores.

Even though sport-caught salmon do not have a market price, the value to anglers can be measured by their willingness to pay (WTP) for fishing trips. WTP includes the amount of money anglers actually pay (i.e., angler spending) plus the additional amount that they would be willing to pay to continue sport fishing for salmon. The amount that anglers would be

willing to pay over and above what they actually pay is the measurement of the net economic value (or the value received) to anglers. The net economic value of the sport fishery to producers (e.g., charterboat operators, guides, and other sport fishing-related businesses) is measured by the net income (or profit) generated by sales to recreational anglers. Based on the study by Jones & Stokes Associates (1991), spending by resident anglers on sport fishing in Southeast Alaska in 1988 totaled $40.7 million, with $38.9 million being spent in Southeast Alaska. Of this spending, approximately 40 percent was trip-related expenditures (e.g., lodging, motor fuel, equipment rental) and the remaining 60 percent was for boat, plane, and cabin-related expenses. Boating-related expenses accounted for nearly $23 million of the $40.7 million in sport fishing-related expenses. (Note: Some spending by Southeast Alaska resident anglers occurred in other Alaska areas and outside Alaska, such as mail order spending.)

Spending by nonresident anglers (i.e., persons living in Alaska, but outside of Southeast Alaska) on sport fishing in Southeast Alaska in 1988 totaled approximately $22.4 million. Nearly 90 percent of this spending was made by persons residing outside of Alaska. Approximately 62 percent ($13.9 million) of nonresident angler spending was transportation related (including package fishing trips, charter/guide services, and other transportation within Southeast Alaska) and the remaining 38 percent was on fishing-related costs.

The amount of angler spending in Southeast Alaska that is salmon related can be approximated based on the proportion of trips that were identified by resident and nonresident anglers as targeted on salmon. For resident anglers, 58 percent of all sport fishing trips are targeted on salmon and 48 percent of sport fishing trips made by nonresident anglers are targeted on salmon. Based on these percentages, angler spending for salmon sport fishing in Southeast Alaska in 1988 was estimated to be $22.5 million for resident anglers and $10.8 million by nonresident anglers.

As indicated above, the net economic value of the recreational salmon fishery is comprised of the additional (or net) WTP by anglers to fish for salmon plus the net income to charterboat operators, guides, and other businesses who provide goods and services to recreational anglers. Based on a study by Jones & Stokes Associates (1991), the net economic value of sport fishing for salmon in Southeast Alaska in 1988 was estimated at $24.8 million, with resident anglers accounting for $19.3 million and nonresident anglers accounting for $5.5 million. The net income to sport fishing-related businesses was estimated at $3.9 million, based on angler spending of $33.3 million and an average net income coefficient of 11.6 percent for sport fishing-related businesses.

#### 3.3.3.8 Subsistence and Personal Use Fisheries

More than 3,000 subsistence, personal use, and combined (subsistence and personal use) salmon fishing permits were issued in the southeast portion of the State in 1996; this included 593 subsistence, 144 personal use, and 2,284 combined permits. The salmon harvest of 33,000 fish included 9,600 in the subsistence fisheries, 30 in the personal use fisheries, and 23,400 in the combined fisheries; nearly 89 percent of the harvest consisted of sockeye salmon.

### 3.3.3.9 Fishing Communities

This section describes the affected environment to assess changes in economic and social conditions in potentially affected communities in Southeast Alaska. The affected human environment is described for the most recent time frame for which data are consistently available, but reference is made to conditions in earlier years or changes over longer periods of time to the extent that they illustrate trends or tendencies important to the analysis.

**Regional Overview**

Southeast Alaska is a large region with a small population. The U.S. Census Bureau reports that in 1997 the population was 71,000 persons. Southeast Alaska has an economy that is dependent on income derived from commercial and recreational fishing activities and a labor force that cannot easily transfer between occupations in the region (ADF&G 1997) because communities are small and isolated, and offer few employment alternatives.

There are seven boroughs (counties) containing 33 communities in Southeast Alaska, as shown in Figure 3.3-7. In order of population, the boroughs are Juneau, Ketchikan Gateway, Sitka, Outer Ketchikan-Prince of Wales Island, Wrangell-Petersburg, Skagway-Yakutat-Angoon, and Haines. The largest communities are Juneau, Ketchikan, Sitka, Petersburg, Craig, Wrangell, Skagway, Haines, and Yakutat. Only Hyder, Haines, and Skagway have road links to Canada and the southern United States and few communities have road links to each other. All communities have one or more small boat harbors. Seventy-five percent of the harvesters in the commercial and personal use fisheries live in the communities and either moor their boats in the harbors or berth them nearby. Approximately 85 percent of troll permit holders are Alaska residents.

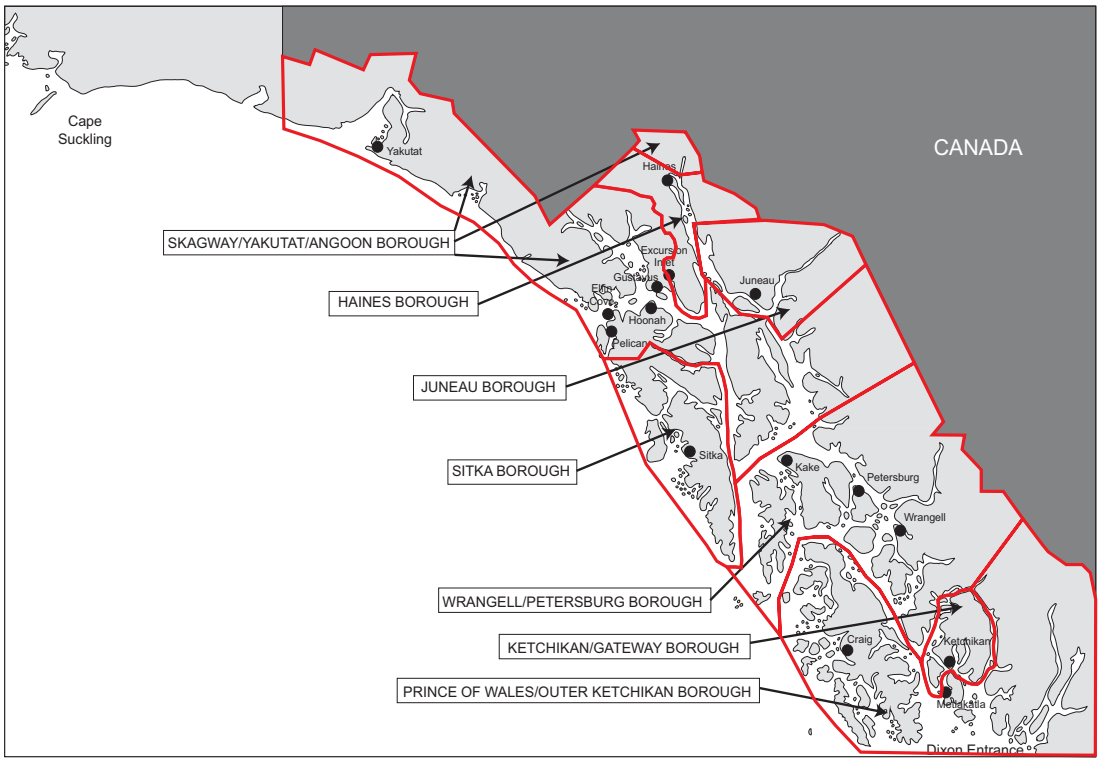



**Figure 3.3-7.** Southeast Alaska boroughs and major port communities.

**Population Characteristics**

The population of Southeast Alaska grew at a rate of approximately 2.8 percent annually between 1980 and 1990, but growth slowed to approximately 0.9 percent annually between 1990 and 1997. Growth in the City and Borough of Juneau has surpassed other boroughs in absolute terms, with more than 10,000 residents added between 1980 and 1997. In relative terms, the largest population growth from 1980 to 1997 occurred in the Outer Ketchikan-Prince of Wales Island borough, which added more than 3,000 residents (5.1 percent). All boroughs experienced a population growth between 1980 and 1990 but three boroughs (Ketchikan, Sitka, and Wrangell-Petersburg) showed slight declines between 1990 and 1997.

Approximately 71 percent of residents in Southeast Alaska are Caucasian; 20 percent American Indian, Aleut, or Eskimo; 4 percent Asian or Pacific Islander; 3 percent Hispanic; and 1 percent African-American (U.S. Census 1996). The percent of population of American Indians, Aleuts, or Eskimos is substantially higher than for the State as a whole, which is 12.6 percent. Communities with predominately American Indian, Eskimo, or Aleut people included Angoon (78.8 percent), Hoonah (72.3 percent), Hydaburg (91.0 percent), Kake (75.1 percent), Kasaan (77.8 percent), and the Metlakatla Census Designated Place (CDP) (84.5 percent) (U.S. Census 1990). Communities with approximately equal numbers of Native Americans and Caucasians included Yakutat and Klawock. Communities predominately inhabited by Caucasians included the Edna Bay CDP, Elfin Cove CDP, Gustavus CDP, Hollis CDP, Juneau, Meyers Chuck CDP, Petersburg, Port Alexander, Skagway, Tenakee Springs, and Thorne Bay.

**Employment, Income, and Poverty Levels**

Approximately 27 percent of the labor force in Southeast Alaska[7] is employed by local, state, and federal government, making this the largest labor sector, followed by service industries with 25 percent (Table 3.3-2). Retail and wholesale trade accounts for 18 percent of employment for the region, followed by agriculture, forestry, and fisheries (7 percent); manufacturing, including seafood processing (7 percent); transportation and public utilities (7 percent); construction (6 percent); and business and financial services (5 percent). The prominence of agriculture, forestry, and fisheries sectors varies substantially among the boroughs, with the highest percentage of employment occurring in the Wrangell-Petersburg Borough (23 percent) and the lowest in Ketchikan (5 percent); data for the City and Borough of Juneau were not available. The Haines, Outer Ketchikan-Prince of Wales Island, and Sitka boroughs had 11, 12, and 14 percent, respectively, of their labor force in this sector. As the State Capitol, The City and Borough of Juneau had the highest percent of labor in the government sector (35 percent). Haines (10 percent) had the lowest percent, and all other boroughs had from 20 to 26 percent of the labor force in the government sector.

Per capita personal income in Southeast Alaska averaged $27,747 (U.S. Census 1994), slightly higher than the statewide average of $26,266. The Skagway-Yakutat-Angoon Borough had the highest per capita income ($46,392) followed by Ketchikan ($29,148),

[7] The most recent data on employment were not available for the Skagway-Yakutat-Angoon Borough. Percentages are based on the remaining six boroughs.

**Table 3.3-2.** Key labor and income statistics for Southeast Alaska boroughs.

| Borough | Government | Services | Retail & Wholesale Trade | Manufacturing | Transportation & Public Utilities | Agriculture, Forestry, Fisheries | Construction | Finance, Insurance, Real Estate | Per Capita Personal Income (1994) | % Below Poverty (1998) | % Unemployed (1996) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Haines | 10% | 28% | 23% | 7% | 10% | 11% | 7% | 3% | 22,226 | 9.2% | 11.5% |
| Juneau | 35% | 27% | 18% | 2% | 7% | 0% | 5% | 5% | 27,278 | 5.6% | 6.3% |
| Ketchikan-Gateway | 21% | 24% | 19% | 13% | 7% | 5% | 6% | 5% | 29,148 | 4.2% | 8.7% |
| Prince of Wales | 26% | 14% | 16% | 16% | 7% | 12% | 5% | 3% | 16,517 | 9.1% | 13.4% |
| Sitka | 21% | 31% | 16% | 4% | 6% | 14% | 5% | 3% | 23,631 | 4.8% | 6.5% |
| Skagway-Yakutat-Angoon | ND | ND | ND | ND | ND | ND | ND | ND | 46,392 | 8.9% | 10.7% |
| Wrangell-Petersburg | 20% | 16% | 14% | 12% | 6% | 23% | 5% | 5% | 25,034 | 5.7% | 6.2% |
| **Region Total** | **27%** | **25%** | **18%** | **7%** | **7%** | **7%** | **6%** | **5%** | **27,747** | **6.8%** | **9.0%** |

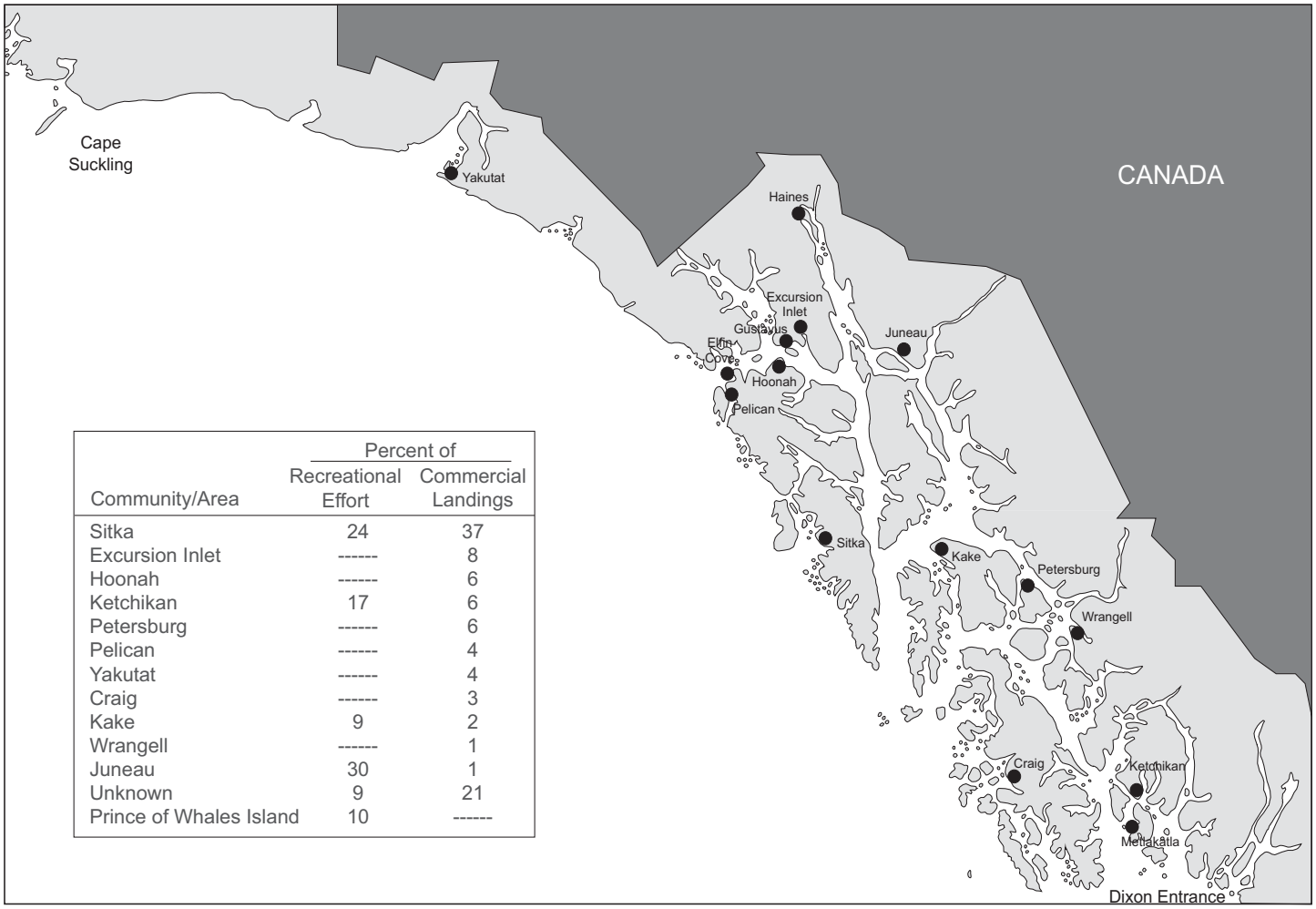
ND = No Data
Source: OSU/REIS et al.

Juneau ($27,278), Haines ($26,226), Wrangell-Petersburg ($25,034), Sitka ($23,631), and Prince of Wales Island ($16,517). Haines had the highest poverty level of any Southeast Alaska borough, with 9.2 percent of its population below the federal poverty level, followed by Prince of Wales Island (9.1 percent), Skagway-Yakutat-Angoon (8.9 percent), Wrangell-Petersburg (5.7 percent), Juneau, (5.6 percent), Sitka (4.8 percent), and Ketchikan (4.2 percent). Unemployment rates were also highest in the Prince of Wales Island Borough (13.4 percent). Haines had an 11.5 percent unemployment rate, followed by Skagway-Yakutat-Angoon (10.7 percent), Ketchikan (8.7 percent), Sitka (6.5 percent), Juneau (6.3 percent), and Wrangell-Petersburg (6.2 percent) (Table 3.3-2).

The communities most likely to be affected by the federal action proposed in this FPEIS are those where commercial salmon trollers and sport salmon fishermen make the most landings. Between 1995 and 1998, 37 percent of troll salmon landings were made in Sitka, followed by Excursion Inlet, (8 percent); Petersburg, Ketchikan, and Hoonah (6 percent); and Yakutat and Pelican (4 percent). Twenty-one percent of troll landings during this period were to "unknown" ports because the fish were sold by catcher-seller vessels over the dock to the public and to restaurants or were sold by exporters. In some cases these were probably landings in ports outside Southeast Alaska. The City and Borough of Juneau had 30 percent of the marine recreational fishing effort in 1997, followed by Sitka (24 percent), Ketchikan (17 percent), Prince of Wales Island (10 percent), and the Kake-Petersburg-Wrangell-Stikine area (9 percent). As noted earlier, the Sitka area currently accounts for 47 percent of the sport harvest of chinook and 27 percent of the sport harvest of coho.

The Sitka Borough accounts for the largest share of income derived from troll and sport salmon fisheries (32 percent) followed by the City and Borough of Juneau (16 percent). The Skagway-Yakutat-Angoon Borough, containing the port communities of Yakutat, Hoonah, Pelican, Gustavus, and Elfin Cove, accounts for approximately 15 percent of the income derived from these fisheries, followed by The Ketchikan Gateway Borough (12 percent); Wrangell-Petersburg (11 percent); Prince of Wales Island, containing the ports of Metlakatla and Craig (7 percent); and Haines, containing the ports of Haines and Excursion Inlet (7 percent) (Figure 3.3-8).

The Alaska Department of Community and Economic Development (1998) has identified the number of active commercial fishing permits, the percentage of the 1998 population having permits, and the overall or total importance of fisheries for 18 communities in Southeast Alaska (Angoon, Craig, the Edna Bay CDP, Haines, Hoonah, Hydaburg, Kake, Ketchikan, Klawock, the Metlakatla CDP, the Meyers Chuck CDP, Pelican, Petersburg, Port Alexander, Sitka, Tenakee Springs, Wrangell, and Yakutat). Commercial fishing is a major source of income in all but seven of the communities. Communities having processing and/or cold storage plants include Craig, Hoonah, Kake, Ketchikan, the Metlakatla CDP, Pelican, Petersburg, Sitka, Wrangell, and Yakutat (Table 3.3-3 and Appendix 4, Southeast Alaska Community Profiles).




| Community/Area | Percent of Recreational Effort | Percent of Commercial Landings |
|---|---|---|
| Sitka | 24 | 37 |
| Excursion Inlet | ------ | 8 |
| Hoonah | ------ | 6 |
| Ketchikan | 17 | 6 |
| Petersburg | ------ | 6 |
| Pelican | ------ | 4 |
| Yakutat | ------ | 4 |
| Craig | ------ | 3 |
| Kake | 9 | 2 |
| Wrangell | ------ | 1 |
| Juneau | 30 | 1 |
| Unknown | 9 | 21 |
| Prince of Whales Island | 10 | ------ |

**Figure 3.3-8.** Distribution of commercial salmon landings and recreational salmon fishing effort among Southeast Alaska ports and community areas (based on 1995 to 1998 landings).

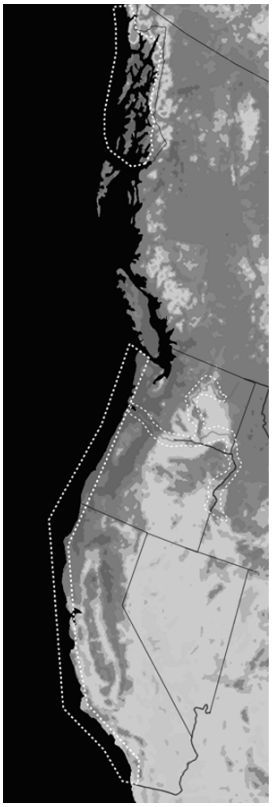
**Table 3.3-3.** Active commercial fishing permits, percent of community involvement, and overall importance of commercial fishing by community, 1998.

| Community/CDP | Number of Commercial Permits | % of Population | Overall Commercial Importance |
|---|---|---|---|
| Angoon | 62 | 10.6 | Major source of income |
| Craig | 209 | 9.7 | Part of economic base |
| Edna Bay CDP | 16 | 28.6 | Part of economic base |
| Elfin Cove CDP | 31 | 62.0 | Participate in fisheries |
| Gustavus CDP | 36 | 9.8 | Some fisheries |
| Haines | 132 | 9.0 | Part of economic base |
| Hollis CDP | --- | --- | Not a source of income |
| Hoonah | 121 | 13.5 | Major source of income |
| Hydaburg | 41 | 10.1 | Major source of income |
| Juneau | 511 | 1.7 | Some fisheries |
| Kake | 77 | 9.8 | Some fisheries |
| Kasaan | 2 | 4.9 | Not a source of fisheries |
| Ketchikan | 438 | 5.2 | Part of economic base |
| Klawock | 42 | 6.4 | Major source of income |
| Metlakatla CDP | 47 | 3.1 | Major source of income |
| Meyers Chuck CDP | 5 | 16.1 | Major source of income |
| Pelican | 45 | 30.2 | Major source of income |
| Petersburg | 502 | 14.8 | Major source of income |
| Port Alexander | 36 | 40.0 | Major source of income |
| Sitka | 589 | 6.7 | Part of economic base |
| Skagway | 2 | 0.2 | Not a source of fisheries |
| Tenakee Springs | 19 | 18.8 | Major source of income |
| Thorne Bay | 25 | 4.2 | Some fisheries |
| Wrangell | 264 | 10.2 | Major source of income |
| Yakutat | 175 | 21.6 | Major source of income |
| **Total** | **3,427** | | |

CDP = Census Designated Place

## 3.4 Pacific Coast

### 3.4.1 Physical Environment



Salmon fisheries managed through the Council occur within the EEZ (3 to 200 miles offshore) off the Washington, Oregon, and California coasts. The region extends from the Washington/Canadian border south to the Mexican border, but nearly all salmon fisheries are located north of Point Conception, California. Salmon fisheries occur predominately along the continental shelf within 35 miles of the coastline. This area is primarily in the Coastal Range ecoregion, which extends from the Olympic Peninsula rainforest to the San Francisco Bay area. The Pacific Coast is influenced by medium to high rainfall (78 to 96 inches per year) caused by the interaction between marine weather systems and coastal mountains ranging up to 4,000 feet in elevation. Between the ocean and the mountains lies a narrow coastal plain. Most tributary streams are short and have steep gradients, thus the streams are prone to low flows during periods of drought (typically July and August). River flows peak during winter rainstorms, but snowmelt in spring may cause a second period of high runoff. The region is forested primarily with Sitka spruce, western hemlock, and western red cedar. Forest undergrowth is composed of numerous types of shrubs and herbaceous plants. Many of the watersheds have been degraded by industrial and residential development, agriculture, logging, and hydroelectric operations.

The oceanic environment is contained within the Central Pacific Gyre. The southern flowing California Current forms the eastern boundary of this ecosystem. Seasonal variation in the pattern of coastal circulation is the result of changes in direction of the dominant winds associated with large-scale atmospheric pressure cells over the eastern north Pacific Ocean (Aleutian Low and Equatorial High). As currents flow south along the West Coast during the spring and summer, a combination of the northwesterly winds and the earth's rotation causes the surface waters to be deflected offshore. As the surface water moves offshore, it is replaced with cold, nutrient-rich waters from below. This process of upwelling introduces the nutrients (nitrates, phosphates, and silicates) that are essential for the high phytoplankton production, which forms the basis for the oceanic food chain.

Environmental fluctuation in this annual process can significantly change the total production capacity of the Central Pacific Gyre ecosystem. The sea-surface temperature patterns in the eastern North Pacific alternate between warm and cool eras, with an average period of about 17 years (Wooster 1995). Near-surface ocean conditions in the eastern North Pacific are linked to behavior of the Aleutian Lows. The initiation of such eras and the occurrence of anomalous warm years are related to El Niño southern oscillation events that have a strong extra-tropical effect. These events intensify surface warming along the West Coast which in turn increases the vertical distance, or thermocline, between the nutrient rich cold water and the warmer, nutrient-poor, surface water. This affects nutrients

available for phytoplankton production during the spring and summer and, as plankton is the base of the aquatic food chain, impacts the entire ecosystem.

## 3.4.2 Biological Environment

### 3.4.2.1 Salmonid Species

Ocean salmon fisheries in Council management areas harvest primarily chinook and coho, though small numbers of pink salmon also are harvested, especially in odd-numbered years. Fisheries for chum or sockeye occur only rarely in Council management areas, although these stocks pass through Pacific Coast waters off Washington on their way to inshore areas where they support major fisheries. Chinook and coho caught in Council fisheries originate from rivers ranging from the United States/Canada border to the south near Point Conception, California, with rare occurrences as far south as Los Angeles. Major runs originate in Puget Sound, the Columbia River system, the Klamath River, the Sacramento-San Joaquin River systems in California, and coastal Oregon streams.

Because of differences in abundance, run timing, and migration patterns, Pacific Coast fisheries catch these stocks at different rates. Recently, restrictions on fishing areas have also affected the frequency with which various stocks are taken. Since the late 1980s the Central Valley fall run has accounted for more than 80 percent of Council management area chinook harvests. Lower Columbia River chinook have comprised approximately 7 percent of the harvest and chinook runs from Puget Sound, the Klamath River, and the South Oregon/North California ESUs have comprised 2 to 3 percent of the harvest. Washington coastal chinook stocks probably account for less than 2 percent of the harvest. Chinook from the Upper Columbia summer/fall ESU, Snake River fall, up-river spring/summer, Snake River spring, Willamette spring, and Oregon Coastal ESUs each account for probably less than 1 percent of harvest. The contribution to harvest of Central Valley spring run and Central California coastal chinook is also small.

Coho runs that support Pacific Coast fisheries are primarily from streams and hatcheries in Puget Sound and on the Washington coast, hatcheries in the lower Columbia River, and streams and hatcheries on the Oregon coast. NMFS has identified the following six coho ESUs (see Figure 3.2-2):

- Central California
- Southern Oregon/Northern California Coast and Oregon Coast Natural (OCN)
- Lower Columbia/Southwest Washington
- Puget Sound/Strait of Georgia
- Olympic Peninsula
- Puget Sound/Strait of Georgia.

There are two primary stock composition/abundance models used for managing coho in the Pacific Coast fishery. They include the Oregon Production Index (OPI) and the coho Fishery Regulation Assessment Model (FRAM). Because of the way harvest data are aggregated in the two fisheries, coho stock groupings discussed in Chapter 4 do not conform directly to the above ESU designations; rather, coho stocks are grouped into three

categories that include OPI, Washington Coast /Puget Sound 1, and Washington Coast/Puget Sound 2. The OPI group contains stocks from the lower Columbia River, Oregon coast, and northern California. The Washington Coast/Puget Sound 1 group contains stocks included in the FRAM model, and the Washington Coast/Puget Sound 2 group contains stocks from that area not included in the FRAM model. Since the late 1980s, the OPI group has accounted for more than 70 percent of the Pacific Coast coho catch, Washington Coast/Puget Sound 2 has accounted for approximately 20 percent, and Washington Coast/Puget Sound 1 group has accounted for less than 10 percent of the catch.

In recent years, many naturally spawning salmonid populations have declined as a result of habitat loss and degradation; inadequate riverine passage and flows because of hydropower, agriculture, logging, and other developments; overfishing; increased predation and competition with hatchery fish; declines in freshwater productivity related to drought; and declines in marine productivity related to climate conditions (El Niño). While naturally spawning salmon comprise a minority of the harvest, these declines have necessitated reduced harvests throughout the Council management area.

With the important exceptions of the Central Valley fall run ESU, the Oregon Coast ESU, the Upper Columbia River Summer- and Fall-run ESU, and perhaps the Washington Coast ESU, West Coast chinook runs have been depressed in recent years (Table 3.4-1); however, curtailing fishing has enabled spawning goals of some stocks to be achieved. [8]

The abundance of coho salmon has been depressed coast-wide since approximately 1991 (Council 1999a) (Table 3.4-1). Three coastal stocks (OCN, Southern Oregon/Northern California, and Central California) encompass the Oregon coast and northern and central California coast and are listed as threatened. Coho returns in 1997 and 1998 were exceptionally low. North of Cape Falcon, several natural coho stocks are healthy and others depressed.[9]

Pink salmon runs, which occur in odd-numbered years, have remained abundant and stable along the portion of the Pacific Coast within their range. Puget Sound stocks averaged 2.1 million and Fraser River stocks averaged approximately 14.6 million annually from 1977 to 1995 (Salmon Technical Team [STT] 1997). Recent returns for both stocks have been above the long-term average.

[8] Along the Washington coast, indices of fall chinook spawning escapements typically exceeded escapement goals after 1983 (Table 3.4-1) while runs of spring chinook have been below escapement goals since 1977. In Oregon, escapement indices for north migrating fall chinook consistently exceeded goals, and recent escapement levels have been higher than during the 1960s and early 1970s (Table 3.4-1). Escapements of spring and fall chinook to the Rogue River and spring chinook to the Umpqua River have been relatively low since approximately 1989. In northern California, the spawning escapement of Klamath fall chinook increased from 1995 to 1998 compared to the early 1990s. Escapement of chinook to other coastal streams in California is not well documented (Myers et al. 1998). Fall chinook returns to the Central Valley, California, have been relatively large since 1995 (up to 200,000 spawners), but significant straying from hatcheries makes evaluating productivity from naturally spawning stocks questionable (Council 1999a).

[9] From 1989 to 1998, OCN coho returns were below escapement goals 6 of 10 years in spite of greatly reduced harvest effects (Table 3.4-1). Among the four coastal Washington coho systems managed for natural production (Queets, Grays Harbor, Hoh, and Quillayute), escapement goals were not met in 65 percent of the years during 1988-1997. In 1998, coho returns to the Queets and Grays Harbor streams were exceptionally low even though coastal fisheries in British Columbia, Washington, and Oregon were significantly reduced.

**Table 3.4-1.** Escapement trends and status of key chinook and coho stocks in Council management areas.

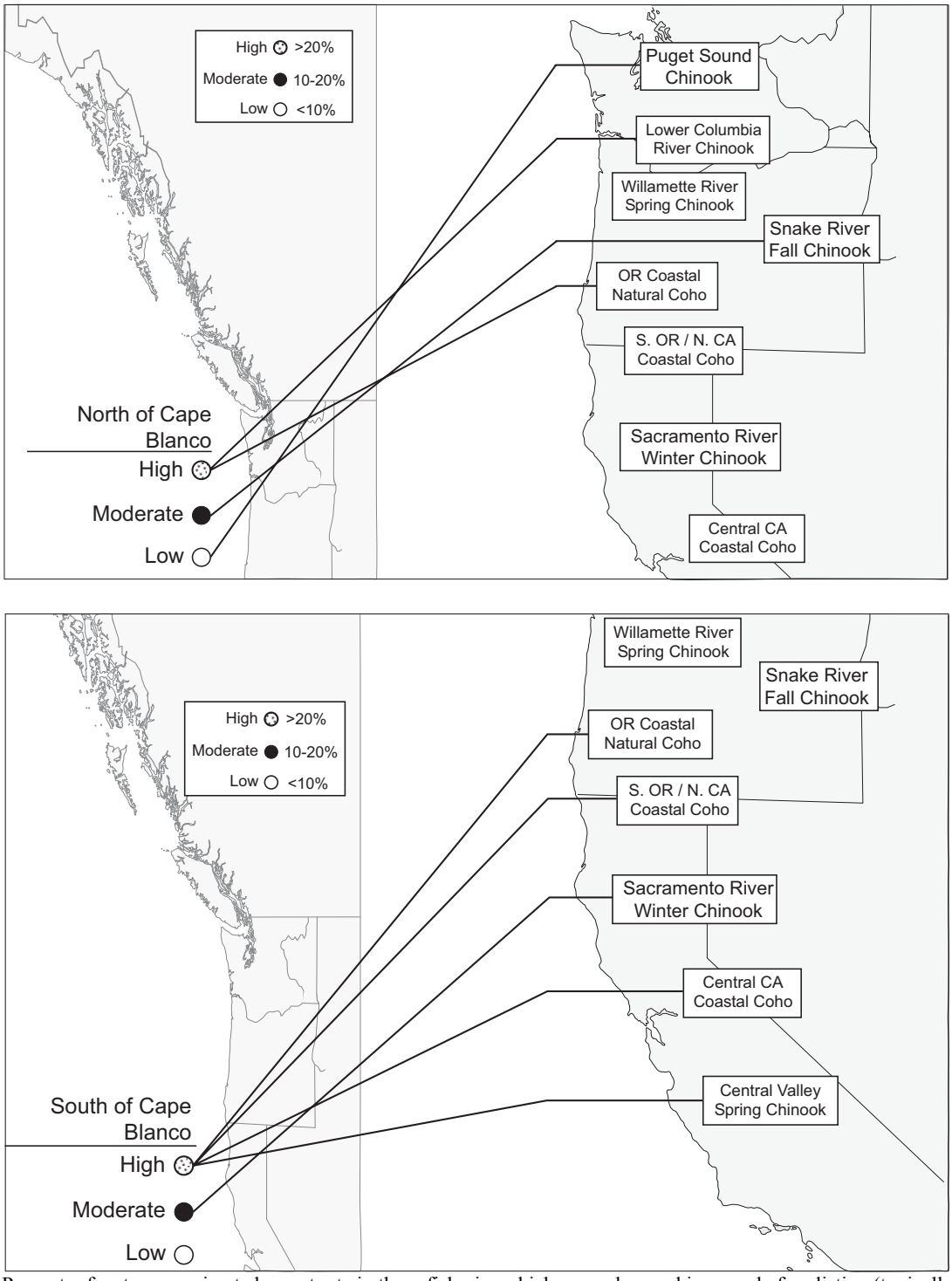
| Stock Name | Escapement Trend Past 10 years | % of Years Escapement Goal Met | Notes |
|---|---|---|---|
| Washington Coast Fall Chinook | variable | 100 | Includes Willapa, Grays Harbor, Queets, Hoh, Quillayute systems/ escapement high since 1983 |
| Washington Coast Spring Chinook | stable but low | 0 | Includes Quillayute, Queets, Grays Harbor systems |
| North Migrating Oregon Coast Fall Chinook | variable | 100 | Escapement high since 1983 |
| Rogue River Fall Chinook (local/south migrating) | variable | | Escapement low since peak in 1986-1988 |
| Oregon Coast Fall Chinook (local/south migrating) | variable | 0 | Includes smaller index streams |
| Oregon Coast Spring Chinook (local/south migrating) | variable and downward | | Includes Rogue, Umpqua systems |
| Klamath R. Fall Chinook | variable, cyclic | 50 | |
| California Coastal | low (poor data quality) | | Listed stocks |
| Sacramento R. Fall Chinook | variable | 40 | Escapement mostly hatchery strays |
| Sacramento R. Winter Chinook[1/] | variable | | Listed Stocks/escapement down since 1988, except 1988 |
| Sacramento R. Spring Chinook[1/] | variable | | Listed Stocks/escapement large return in 1988 |
| San Joaquin R. Fall Chinook | increasing | | |
| Washington Coast Coho | variable | 35 | Includes Quillayute, Hoh, Queets, Grays Harbor systems |
| Oregon Coastal Natural Coho[1/] | variable | 40 | Listed Stocks/escapement low 1997-1998 |
| Central California Coho[1/] | low | | Listed |

Notes: [1/] Stocks listed under ESA
Specific information relative to escapement goals is missing for some stocks because of the absence of escapement goals or adequate monitoring data.
Other listed species in this region (e.g., steelhead, sockeye, cutthroat trout, bull trout) are not encountered by Pacific Coast fisheries.
Source: Council 1999b.
Data exclude Columbia River and Puget Sound stocks.

### 3.4.2.2 Listed Salmonid Species

Listed chinook and coho ESUs that are taken in Pacific Coast fisheries are shown in Figure 3.4-1, which shows harvest rates and the distribution of harvest for key chinook and coho ESUs. Life history information and factors for decline are summarized below for all Council management area ESUs other than the Columbia River basin ESUs, which are covered in the next section. Unless otherwise noted, information on chinook ESUs is summarized from Matthews and Waples (1991) (Snake River spring/summer chinook), Busby et al. (1996) (steelhead), and Myers et al. (1998) (all other chinook). Table 3.4-2 summarizes nonharvest-related factors for decline by ESU.

There are several other salmonid populations listed from streams within the Council's jurisdiction including Hood Canal summer-run chum salmon; Columbia River chum




Notes: Percent refers to approximate harvest rate in these fisheries which were observed in years before listing (typically 1980s and early 1990s).
Low, medium, and high references are for comparison purposes in this document. Depending on various factors, a harvest rate which is high for one stock may be moderate for another stock.

**Figure 3.4-1.** Historic harvest rates for listed chinook and coho ESUs in Pacific Coast fisheries.

**Table 3.4-2.** Status and nonharvest-related factors for decline of Pacific Coast chinook and coho salmon ESUs.

| ESU (status) | Recent Natural Run Size | % Wild in ESU | Historic Run Size | Population Trend | Fisheries Effects |
|---|---|---|---|---|---|
| **Sacramento River Winter Run Chinook ESU (E 1/94)** Construction of Shasta Dam in the 1940s eliminated access to all historic spawning habitat for winter-run chinook salmon in the Sacramento River Basin. This ESU is comprised of a single population with very limited spawning and rearing habitat, which increases its risk of extinction due to local catastrophe or poor environmental conditions. Supplementation of the natural spawning run through hatchery-rearing of winter stock has been attempted but results have not been evaluated. Overlaps in run timing and location with fall chinook stocks may pose risks to the genetic integrity of the remaining population. | < 1,000 | | | Currently low but stable. | Moderate in ocean; low in river. |
| **Central Valley Spring Run Chinook ESU (T 9/99)** Historically, spring-run chinook salmon were abundant in the Sacramento River system and dominant in the San Joaquin Basin. Of the historical 6,000 miles of spawning habitat in these two basins, <500 miles now remain and access of spring run salmon has been blocked in the San Joaquin, American, Upper Sacramento and Feather Rivers. This ESU may hybridize with hatchery or natural-origin fall run fish. Reported to be extinct in the Yuba, American, Mokelumne, Stanislaus, Tuolumne, Merced, and San Joaquin Rivers. | Unknown | < 25% | | | Likely high in ocean. |
| **Central California Coho ESU (T 10/96)** Loss of habitat has been identified as the primary factor in stock decline and recent surveys found coho in 47%-57% of streams, which historically supported coho. Recent droughts and lowered ocean productivity have probably reduced run sizes. | < 6,000 | < 20% | 200,000-500,000 in 1940s | Low and declining. | Moderate or high in ocean prior to 1980s. |
| **Southern Oregon/Northern California Coastal Coho ESU (T 5/97)** Boundaries are from Punta Gorda, California northward to Cape Blanco, Oregon with main stocks in the Rogue, Klamath and Trinity Rivers heavily influenced by hatchery production. Recent surveys of 115 of 396 streams in this ESU that once had coho runs show that approximately 64% still support coho. Loss of habitat has been identified as the primary cause of stock decline. | 7,000 | > 30% | Unknown | Natural runs not self-sustaining. | Moderate to high in ocean until 1990s. |
| **Oregon Coast Natural Coho ESU (T 8/98)** Boundaries are from Cape Blanco, Oregon northward to Cape Falcon, Oregon at the southern entrance to the Columbia River. With the exception of the Umpqua River, coho streams within this ESU drain basins westward from the Oregon Coast Range. Widespread habitat degradation is thought to be responsible for much of the decline, Most populations have hatchery plantings, many with out-of-basin but within ESU stock transfers. | 39,000 | < 20% | 390,000-780,000 | Downward | High in ocean until 1990s. |
| **Puget Sound Chinook ESU (T 3/99)** Includes runs from the North Fork of the Nooksack (in the northern part of Puget Sound) southward to tributaries of southern Puget Sound and westward to the Elwah River on the Olympic Peninsula. Habitat throughout the ESU has been blocked or degraded. In general, upper tributaries have been impacted by forest practices and lower tributaries and mainstem rivers by agriculture and/or urbanization. Hatchery fish spawn naturally throughout the region | < 25,000 | 11% | ≤ 690,000 | Mixed | High in B.C. and Puget Sound, low elsewhere. |

Notes: T = threatened, E = Endangered

salmon; Snake River sockeye salmon; Ozette Lake sockeye salmon; and steelhead from five ESUs, including Southern California, South-Central California Coastal, Central California Coastal, California Central Valley, and Northern California. Several additional ESUs, including steelhead, cutthroat, and coho, are candidates for listing (Table 1.3-1). Steelhead, chum, and sockeye salmon are rarely taken in Council management area, hook-and-line fisheries.

Marine habitat within the bounds of Pacific Coast fisheries was not classified as critical habitat because, in making the critical habitat designations, the ocean areas did not appear to need special management consideration. However, critical habitat has been designated or proposed in the freshwater and inland marine areas occupied by Sacramento winter chinook, central California coastal coho, and southern Oregon/Northern California coho (58 FR 33212, 62 FR 62741).

**Sacramento River Winter Run Chinook ESU**

Historical information on ocean impact rates on this stock is limited. Fin clip mark recapture studies done in the early 1970s indicated that impact rates (catch/catch + escapement) ranged from 0.47 to 0.56. More recent estimates for the 1998 brood year indicate that the ocean age-3 harvest rate was 0.23. Impacts occur primarily off the California coast with most occurring south of Point Arena, California (South of the KMZ fishery management area). It is unlikely that the Southeast Alaska fishery affects this run, and there is no interaction with Columbia River basin fisheries. A freshwater fishery effect is minimal (Myers et al. 1998). Current Council management objectives are derived from NMFS' 2002 Biological Opinion, which requires that fisheries be managed to so that impacts do not change substantially relative to 2000 and 2001.

**Central Valley Spring Run Chinook ESU**

Most fishery effects on this stock likely occur in ocean fisheries off California and southern Oregon. Ocean fishery management focuses on the fall run, with no defined management objectives for spring-run fish. Because of the similarity in ocean distribution with fall-run fish and the smaller average size of spring-run fish, spring-run harvest rates are probably lower than fall-run rates, which are approximately 74 percent.

**California Coastal Chinook ESU**

Insufficient information is available on the harvest of this ESU largely because of the absence of representative coded-wire tag groups.

**Puget Sound Chinook ESU**

Ocean exploitation rates on natural stocks average 56 to 59 percent; total exploitation rates average 68 to 83 percent. In general, Puget Sound stocks are affected by fisheries in British Columbia (24 percent exploitation rate from 1978 to 1995) and Puget Sound (42 percent exploitation rate), and are slightly affected by Southeast Alaska (less than 2 percent exploitation from 1988 to 1996 and in previous years) and northern Pacific Coast fisheries (less than 5 percent exploitation from 1978 through the 1990s).

**Central California Coho ESU**

Little is known about ocean distribution or harvest effects on this stock largely because of the absence of representative coded-wire tag groups. It is believed that the stock migrates offshore of California and it is unlikely that it is caught in the Southeast Alaska fishery. There are no effects on this stock from Columbia River basin fisheries.

**Southern Oregon/Northern California Coastal Coho ESU**

Sport and commercial fisheries off northern California and southern Oregon affect this ESU. Southeast Alaska fisheries affect this ESU minimally. Over-harvest, in part a result of basing harvest rates on hatchery production, is thought to have contributed significantly to stock decline.

**Oregon Coast Natural Coho ESU**

Stocks from this ESU are affected primarily by ocean sport and commercial fisheries from northern California to southern Washington. It is unlikely that the Southeast Alaska fishery affects stocks from this ESU and the Columbia River basin fisheries do not affect this stock. Current escapement is thought to be approximately 50 percent of current capacity of the river systems, suggesting that overharvest has played a major factor in decline. Although the long-term escapement trends are downward, the most substantial declines occurred in the early 1970s, coincident with high hatchery production and high ocean harvest rates.

### 3.4.2.3 Non-Salmonid Fish Species

Other fish species taken incidentally in Pacific Coast salmon fisheries include halibut, yellowtail rockfish, canary rockfish, lingcod, and sablefish. Halibut stocks off the Washington, Oregon, and California coasts are in good condition. The majority of groundfish stocks are in fair to poor condition. Canary rockfish, lingcod, and sablefish stocks are declining and appear to be in poor condition. Yellowtail rockfish also are fully utilized, but the stock appears stable. In general, ocean conditions and over exploitation have contributed to stock declines (Council 1998a). The retention of incidental harvest within the recreational fishery is dependent upon bag limit restrictions. In the commercial troll fishery, Pacific halibut and rockfish may be retained in accordance with annual landing restrictions.

### 3.4.2.4 Listed and Unlisted Mammalian Species

Population information and occurrence of listed and unlisted mammals, birds, and reptiles in the Council management area and other areas covered in this FPEIS are summarized in Tables 3.3-1 and 3.4-3. Fishery interactions with these species are rare and are believed to have no substantial effect. More detailed information on these species is provided in Appendix B.

### 3.4.2.5 Listed and Unlisted Avian Species

Approximately 4.5 million seabirds reside and nest along the contiguous West Coast of the United States (Strategic Assessment Branch, NMFS, 1990). The size and diversity of the

**Table 3.4-3.** Non-salmonid species currently listed as threatened or endangered under the ESA known to inhabit the Southeast Alaska, Pacific Coast, or Columbia River basin fishery management areas.

| Species | Areas Present | Population, Status | Listed Status |
|---|---|---|---|
| **Marine Mammals** | | | |
| Steller Sea lion | Pacific Coast, Southeast Alaska | Declining in Alaska; 50% decline in California from 1950-1980. | Threatened |
| Guadalupe Fur Seal (*Arctocephalus townsendi*) | Pacific Coast | 7,408 animals, increasing 14% annually. | Endangered |
| Blue Whale (*Balaenoptera musculus*) | Pacific Coast, Southeast Alaska | 1,785 in California/Mexico stock; trend unknown. | Endangered |
| Fin Whale (*B. physalus*) | Pacific Coast, Southeast Alaska (possible) | 993 in California; otherwise unknown. | Endangered |
| Humpback Whale (*Megaptera novaengliae*) | Pacific Coast, Southeast Alaska | 597 in Pacific Coast stock; trend unknown. | Endangered |
| Right Whale (*Eubalaaena glacialis*) | Pacific Coast, Southeast Alaska | No reliable estimate. | Endangered |
| Sei Whale (*B. borealis*) | Rare in Pacific Coast and Southeast Alaska | No reliable estimate. | Endangered |
| Sperm Whale (*Physeter catodoon*) | Pacific Coast, Southeast Alaska | 1,231 animals; no estimate of trend. | Endangered |
| **Terrestrial Mammals** | | | |
| Columbia White Tailed Deer | Columbia River | No population estimate. | Endangered |
| **Birds** | | | |
| California Brown Pelican | Pacific Coast | Listing may be downgraded from endangered to threatened. | Threatened |
| Aleutian Islands Canada Goose | Pacific Coast, Southeast Alaska | Unknown. | Endangered |
| Marbled Murrelets | Pacific Coast, Columbia River | | Endangered |
| Western Snowy Plover | Pacific Coast, Columbia River | | Threatened |
| Short-tailed albatross | Pacific Coast, Southeast Alaska | | Endangered |
| Spectacled Eider | Southeast Alaska | | Threatened |
| Stellar's Eider | Southeast Alaska | | Threatened |
| Bald eagle | Columbia River | | Threatened |
| American Peregrine Falcon | Columbia River | | Endangered |
| **Reptiles** | | | |
| Green Turtle (*Chelonia mydas*) | Pacific Coast | | Threatened |
| Leatherback Turtle (*Dermochelys coriacea*) | Council | | Threatened |
| Loggerhead Turtle (*Caretta caretta*) | Council | | Threatened |
| Olive Ridley Turtle (*Lepidochelys olivacea*) | Council | Sea turtle populations declining worldwide. | Endangered |

breeding seabird community in this region reflects the variety of nearshore prey environments.

Overall abundance has remained stable or increased for most species of seabirds in recent years (Carter et al. 1998). Some species have experienced declines in localized areas as a result of habitat destruction, human interaction, predation, and oil spills. All populations have fluctuated in response to El Niño conditions and have experienced lower productivity and some degree of colony abandonment during intense El Niño events (e.g., 1982 through 1983 and 1992 through 1993). The major exception to this trend is the common murre (*Uria aalge*), which is the dominant member of the breeding seabird community on the West Coast. This species declined substantially after the 1982 through 1983 El Niño event and has yet to recover in central California and Washington. The primary factors thought to be precluding their recovery include the combined effects of high mortality from gillnet fishing and oil spills, and poor reproduction during subsequent El Niño events (Carter et al. 1998). More information on avian species is provided in Appendix B.

#### 3.4.2.6 Lower Trophic Level Species (Forage Fishes)

Forage species perform a critical role in the complex ecosystem by providing the transfer of energy from the primary or secondary producers to higher trophic levels.[10] The discussion of the status of lower trophic level species in this section is limited to primary prey items of chinook and coho salmon. Juvenile salmonids feed opportunistically upon the available mix of prey items (Pearcy 1998). Squids, euphausiids, amphipods, and small schooling fish are important prey taxa for salmonids off the Pacific Coast. Young coho and chinook occur in the shelf zone in summer-autumn and consume small fish and squid (Gorbatenko 1989). Pink salmon move to deep sea areas as juveniles and feed on plankton, then return to the shelf waters in summer as pre-spawning adults to feed on small fish and squid (Gorbatenko 1989). Spring and summer upwelling off the coasts of California, Oregon, and Washington support the high production of phytoplankton and zooplankton, which forms the basis for the oceanic food chain. The same environmental factors that determine distribution, abundance, and species composition of these resources also affect fish communities.

Off the Pacific Coast, there are important directed fisheries for Pacific herring, Pacific sardine (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), and market squid (*Loligo opalescens*). In 1997 these fisheries contributed 68 percent of total commercial landings in California (Council 1999a). In recent years, the Pacific Coast abundance and landings of northern anchovy have been stable at low levels. Landings of Pacific sardine have increased in recent years with increased biomass and higher quotas. In 1997 sardine supported the second largest (by volume, not value) fishery in California. Squid landings increased recently to record high levels due to increased availability and prices, but decreased dramatically during the El Niño of 1997 through 1998. In 1997 squid supported the largest and most valuable fishery in California. Pacific herring are primarily harvested

[10] Many species undergo large, seemingly unexplainable fluctuations in abundance. Most of these species, including herring, anchovy, sardine, smelt, capelin, and sand lance, have high reproductive rates, are short-lived, attain sexual maturity at young ages, and have rapid individual growth rates such as herring, anchovy, sardines, smelt, capelin, and sand lance. These biological characteristics make the species more susceptible and responsive to seasonal, inter-annual, and decadal shifts in oceanographic conditions within the ecosystem.

in inshore waters under state jurisdiction, and recent landing trends are well below historical long-term averages (CDFG, ODFW, WDFW, personal communications).

## 3.4.3 Human Environment

Much of the following section is based on information from Amendment 14 to the Pacific Coast Salmon Plan (1997) that was completed by the Council in 2000. Unless noted otherwise Amendment 14 is the reference for information presented in the following sections.

### 3.4.3.1 General Fishery Description

Ocean salmon fisheries in Pacific Coast waters are directed toward and harvest primarily chinook and coho salmon. Pacific Coast waters range from 3 to 200 miles off the coasts of Washington, Oregon, and California, and are managed in four major zones (Figure 3.4-2). Although small numbers of pink salmon may be harvested in odd-numbered years, sockeye, chum, and steelhead are only rarely caught in Council management areas.

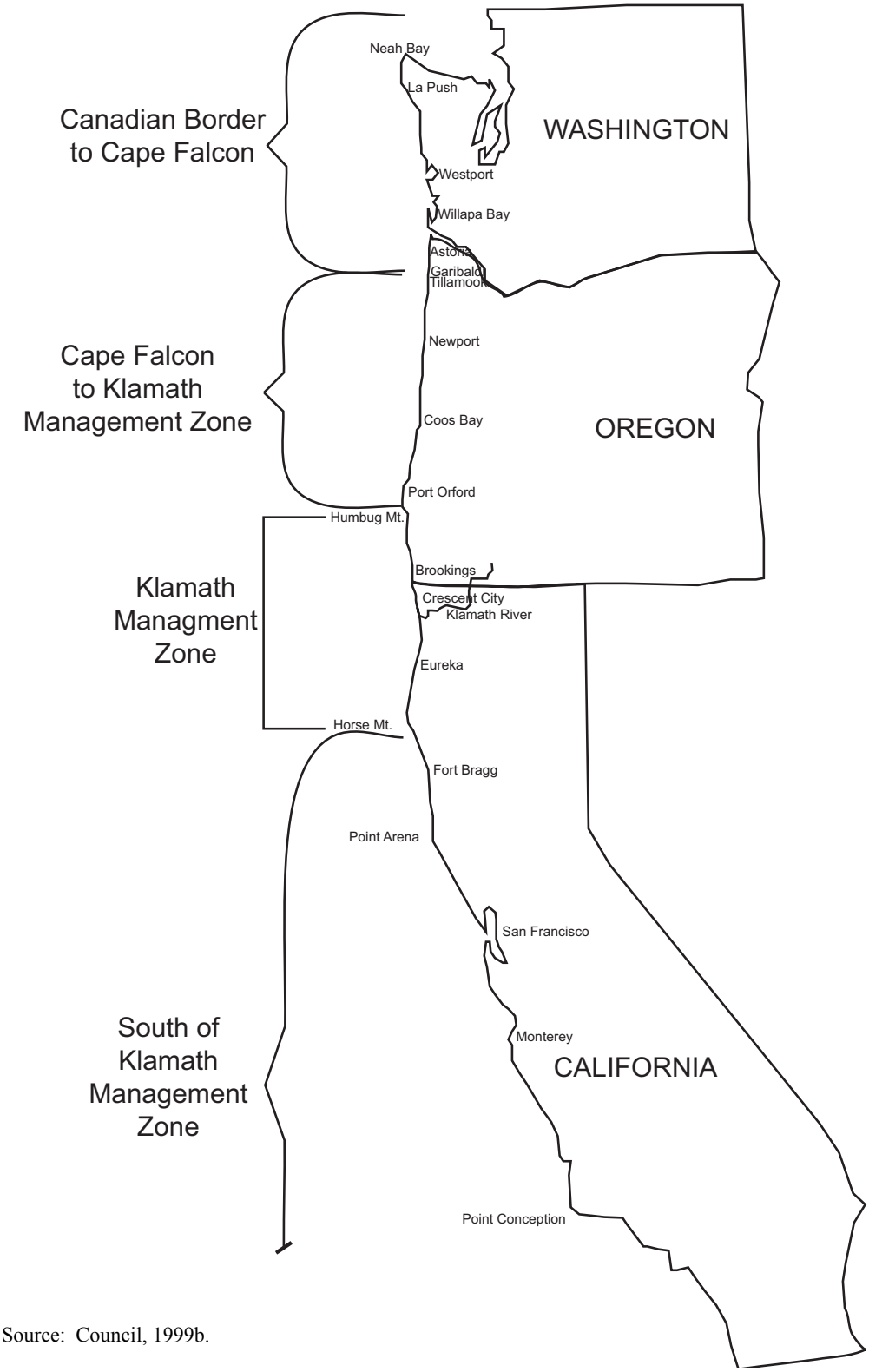
Sport and commercial harvest of coho and chinook is by hook-and-line gear only. The proportion of harvest taken by these two user groups has varied over the years according to abundance and perceived social and economic priorities. From the mid-1970s to 1990, the commercial fleet took approximately 64 percent of the coho and 81 percent of chinook. Since the early 1990s the commercial fleet harvested approximately 40 percent of coho and 73 percent of chinook. Harvest in Council management area is allocated between Tribal and non-Tribal fishers in accordance with judicial interpretations of state treaty obligations. Tribal harvest is taken in commercial fisheries and in ceremonial and subsistence fisheries off the Washington coast.

Since the mid-1970s, approximately 41 percent of the total salmon harvest has been taken in California, 31 percent in Oregon, and 28 percent in Washington. For coho, whose range is generally more northerly, California fisheries have consistently taken less than 10 percent of the harvest and the remainder has been evenly divided between Washington and Oregon. Since the mid-1970s the portion of chinook harvest taken in California fisheries has grown from approximately 55 percent to more than 70 percent during the 1990s. Oregon's share of chinook harvest has remained approximately the same but Washington's share of chinook harvest has decreased from 24 percent in the 1976-1980 period to less than 3 percent from 1994 to 1997.

### 3.4.3.2 Commercial Fisheries and Harvests

Commercial fisheries are limited to trolling, a method where a vessel (i.e., boat) tows numerous lines, with attached lures or baits,[11] through the water. Vessels range in size from less than 20 feet to over 50 feet. Trollers target salmon on salmon migration and feeding grounds, which extend from shore out to approximately 25 miles. Many trollers (typically the larger ones) are also used in Dungeness crab, albacore, sablefish, halibut, and rockfish fisheries. Some troll vessels hold permits in more than one state and travel to

[11] The number of lures or baits that may be used by a boat is limited by regulations that have varied from state to state and year to year, but currently averages less than 30.




Source: Council, 1999b.

**Figure 3.4-2.** Fishery management areas and major fishing ports in the Council management area.

areas distant from their home ports to take advantage of season openings when their own area is closed or to take advantage of better fishing.

Commercial trolling has been practiced in Pacific Coast salmon fisheries since 1912. The Pacific Coast troll fleet grew rapidly in the 1970s simultaneous with rising hatchery production of coho salmon, peaking at 11,239 vessels in 1980. By the mid-1970s fishery managers believed the fleet was overcapitalized and initiated license limitation programs to control participation in salmon fisheries. Permits were first required in Washington in 1974, in Oregon in 1980, and California in 1982.[12] An important element to the state programs is the policy, which varies among the states, regarding the minimum number of permits that should be available. In Washington all permits could, theoretically, lapse or be surrendered to the state by their owners. Limited entry programs in California and Oregon require more permits be made available if the number of permits falls below a minimum.

In 1982, the first year all three states had license limitation programs, 9,535 vessels delivered troll-harvested salmon, somewhat less than in 1978 when an estimated 11,118 vessels made landings. The number of vessels making landings declined from this period to the present estimate of 1,316, which was 36 percent of the 3,678 permits held. Landings were made by 832 vessels in California, 433 in Oregon, and 51 in Washington. Tribal fishers who participate in ocean trolling are not subject to state license requirements or limitations.

Before and during much of the 1970s, fishing seasons for ocean trollers were open from April through September for chinook and from June through September for coho[13] with relatively few restrictions on places to fish. During the 1980s increased conservation concerns led to cutbacks in season lengths and increased area restrictions. Species-specific fishing regulations became common and retention of chinook or coho was limited or prohibited according to time and area. The most severe ocean fishing cutbacks occurred in 1984 in response to poor ocean salmon survival attributed to El Niño ocean conditions. Ocean troll fisheries became increasingly restricted in the 1990s. Some of the major changes in seasons in recent years compared to the 1980s include the elimination of coho fishing south of Cape Falcon, Oregon, and increased closures in the KMZ and nearby areas. North of Cape Falcon, season length decreased in the late 1990s by nearly 50 percent compared to the 1980s.

Commercial troll harvest of chinook in Pacific Coast fisheries was approximately one million chinook annually from 1976 to 1980; 884,000 chinook from 1981 to 1987;

[12] The details of the programs vary among the three states, but in each case owners of the permit must renew it annually by paying a fee and, in some cases, making salmon landings, or the permit becomes invalid. Exceptions have been made in recent years when restrictions to ocean salmon seasons have been drastically curtailed. If the number of permits in Oregon falls below 1,200 then a lottery may be used to achieve the minimum. The Oregon Fish and Wildlife Commission is allowed to suspend the lottery for up to 2 years if it determines the action is appropriate in consideration of the condition of the resource. When the program was first established, the minimum number of permits was set at the number of vessels participating in the ocean troll salmon fishery during the calendar year 1978 (3,158 vessels). Since initially establishing the program, the state legislature has reduced this minimum on several occasions. A lottery has never been held to issue more permits. The greatest number of permits issued was 4,314 in 1980. In 1997 there were 1,286 permits issued. The Washington ocean troll salmon limited entry program was created in 1974 as part of a program that created commercial licenses for all of Washington's commercial salmon fisheries. Unlike Oregon and California, no minimum was set on the number of permits to be issued. The number of permits issued in Washington declined to 323 in 1997.

[13] The late opening of the coho season was designed to increase biological yield and, thus, economic value in the fishery by allowing coho to grow to a larger size.

791,000 chinook from 1988 to 1993; and 615,000 chinook from 1994 to 1997. Within the same periods, average annual coho landings were approximately 1.8 million; 601,000; 418,000; and 27,000 coho, respectively.

Coastwide harvest and value of non-Tribal commercial chinook and coho salmon from 1982 to 1996 are shown in Figure 3.4-3. In the 1990s, there was a southward shift in the concentration of chinook harvest and a northward shift in concentration of coho harvest because of declining fisheries in the north. Seventy-five percent of chinook was taken in California from 1994 to 1997 compared to 58 percent during 1976 to 1980, and 63 to 65 percent during the intervening periods. In Washington, 1997 was the first year there was a chinook-directed non-Tribal commercial troll fishery of some significance since 1993. Because of closures of commercial troll seasons for coho, coho harvest in California and Oregon was zero from 1994 to 1997 while there was a slight (27,000 coho) harvest in Washington. Coho have not been landed south of Cape Falcon, Oregon, in any significant quantities since 1992.

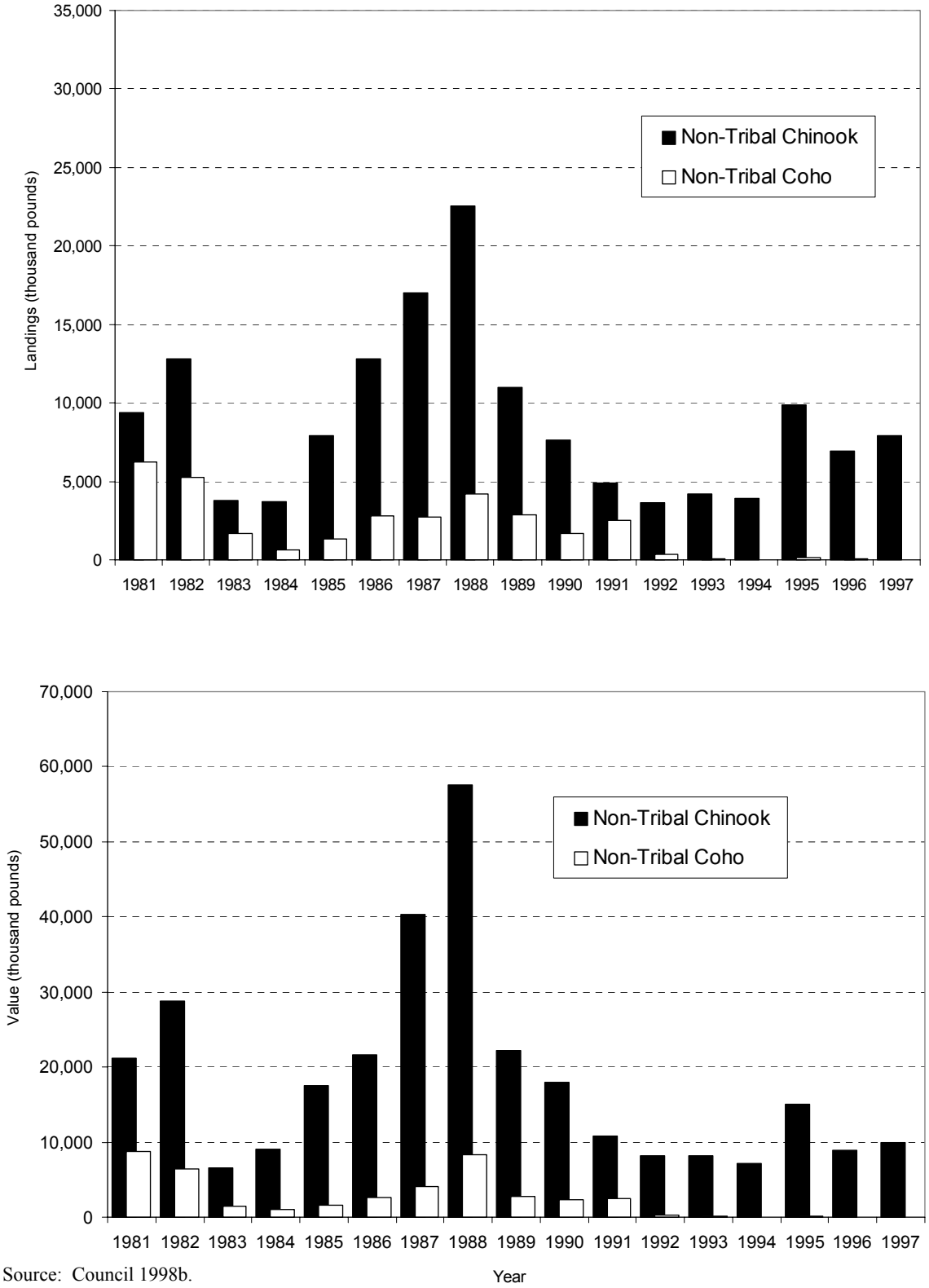
#### 3.4.3.3 Tribal Ocean Fishery

Since the 1970s, there have been separate commercial seasons for American Indians. Harvest quotas or seasons for Tribal fisheries are set through rather complicated negotiations involving coastal and inland Tribes, and coastal and inland commercial and recreational fisheries. In recent years ocean Tribal seasons, or quotas, have been set to allow Tribal fisheries to take approximately 50 percent of the ocean harvest north of Port Leadbetter, Washington. Commercial Tribal fisheries provide food to consumers and generate income in local and state economies through expenditures on harvesting, processing, and marketing of the harvest. The treaty ocean troll fishery harvested 16,000 coho and 15,000 chinook in 1997 compared to 15,000 chinook and 19,000 coho in 1996 (Figure 3.4-4).

#### 3.4.3.4 Seafood Processors

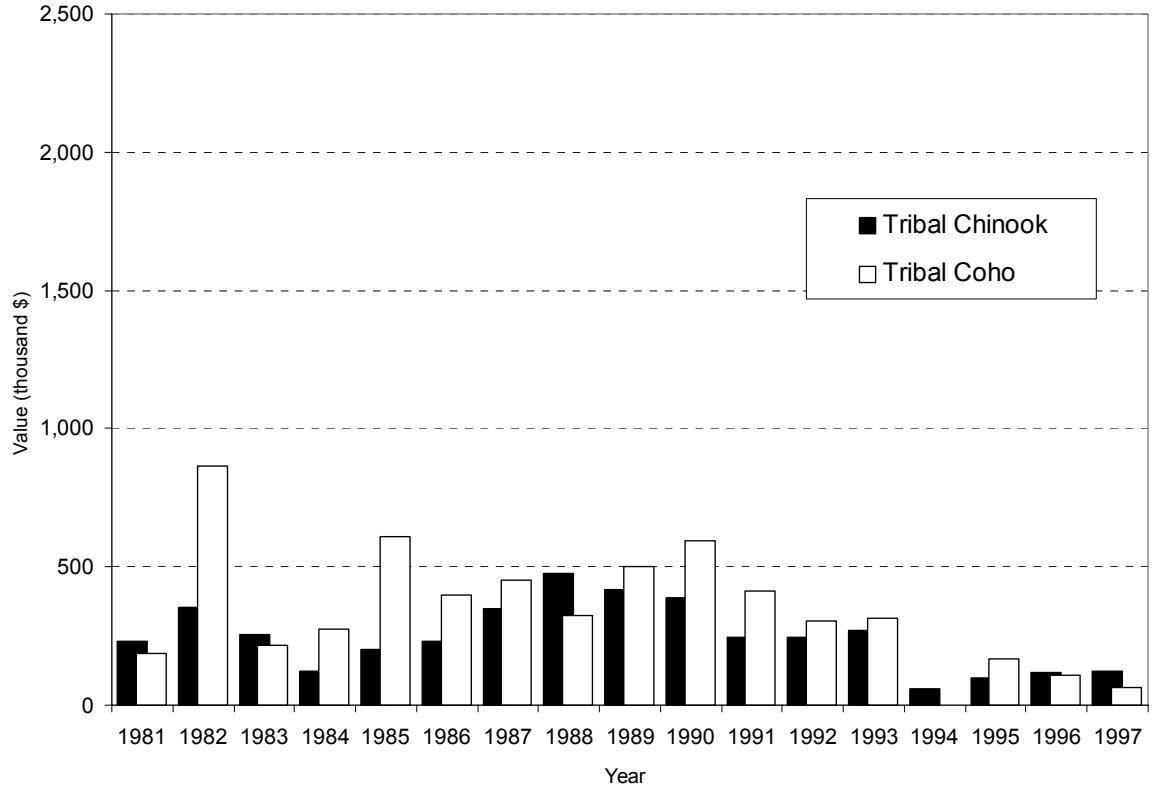
A relatively small number of large processor/buyer firms process most of the ocean salmon catch on the Pacific Coast. Between 1995 and 1997, 1,927 firms had state processor/buyer licenses. These firms included both operators of processing plants and buyers that may do little more than hold the fish before their shipment to a processor or market. In some cases the buyers may be owners of vessels who also own licenses, thus allowing them to sell fish directly to the public or retail markets. The top 24 state-licensed buyer/processor firms handled 50 percent of the ex-vessel value of all Pacific Coast fishery landings and 50 percent of all landings of ocean caught salmon between 1995 and 1997. Approximately 80 percent of the top 24 buyer/processor firms handled salmon. The proportion of smaller (handling less than $500,000 of product) buyer/processor firms handling salmon was approximately 20 percent. The largest salmon buyers tend to buy salmon from four to eight ports.

In California, salmon buyers/processors are largely concentrated in the Monterey/Santa Cruz and San Francisco areas. In past years a significant number of buyers/processors were located in Humboldt County. The net income to buyers/processors in California was




Source: Council 1998b.

**Figure 3.4-3.** Coastwide harvest and ex-vessel value of non-Tribal chinook and coho salmon landings, 1981 to 1997.



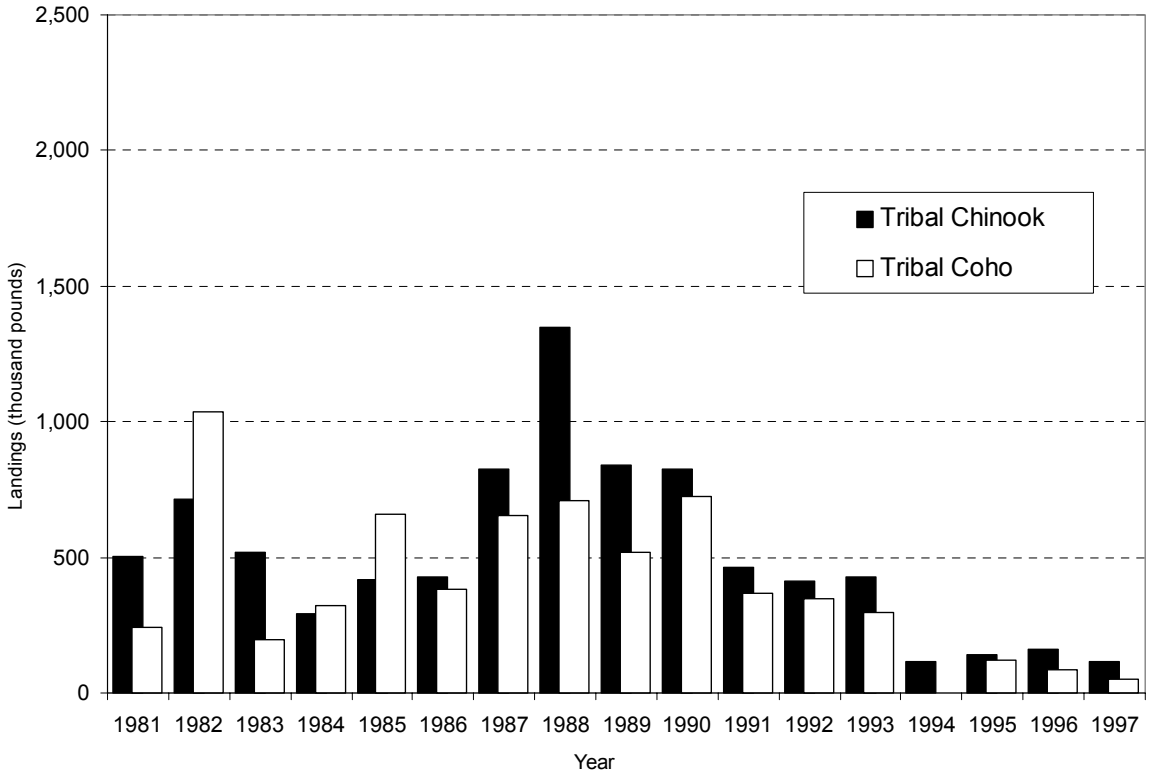




**Figure 3.4-4.** Coastwide harvest and ex-vessel value of Tribal chinook and coho salmon landings, 1981 to 1997.

estimated at $1.9 million in 1993, which represents approximately 39 percent of the net income ($4.9 million) to commercial fishers for that year (USFWS 1995).

### 3.4.3.5 Consumers of Salmon

Pacific Coast salmon fisheries contribute chinook, coho, and pink salmon to North American salmon production. The Pacific Coast chinook harvest is comparable to that of Alaska and Canada, but Pacific Coast coho and pink salmon harvests are less than Canada's harvests and minor compared to Alaska. Pacific Coast salmon products compete in a global salmon market with all species of salmon. Non-salmon fish species and other meat protein sources also compete with salmon and act as substitutes in the market place.

With the introduction of farm-raised salmon, world salmon markets have undergone rapid changes. World salmon supply has tripled since 1980. The estimated 1997 world harvest of salmon from commercial fisheries is near the 1980-1997 average and farmed production continues to increase. The share of the market for farmed salmon has increased from one percent in 1980 to 59 percent in 1997. Increased production of farmed salmon has had major effects on salmon prices and is likely responsible for a continuing slump in wild Pacific Coast chinook and coho prices.

### 3.4.3.6 Commercial Fishery Economic Value

As described in Section 3.3.3.5, the economic value of the commercial salmon fishery can be measured by the value it generates for producers and consumers. The gross revenues generated by the salmon harvest for commercial troll fishers are referred to as the ex-vessel values because the revenues represent what the commercial fishers receive for their product after it leaves the fishing vessel. In 1997 total ex-vessel value for the Pacific Coast troll fishery was $9.8 million. In inflation-adjusted terms, ex-vessel value was 6 percent more than 1996 revenues but was 76 percent less than the 1976-1996 average. The value of the commercial harvest has been at depressed levels for most of the 1990s (Figures 3.4-3 and 3.4-4). Net income to commercial fishers generated by the salmon harvest is the gross revenues received by vessel operators less the costs of production, including wages, operational expenses such as fuel and equipment, and fixed costs such as insurance and depreciation. Based on $9.8 million in ex-vessel value in 1997 and a net income coefficient of 0.40, as derived from Impact Analysis for Planning (IMPLAN) for Pacific Coast commercial fisheries, the net income to salmon trollers is estimated at $3.9 million.

In addition to the net income that the commercial salmon fishery generates for permit holders, the fishery also generates wages and fringe benefits for crew members. Based on a study for southcentral Alaska, wages and fringe benefits for crew members fishing for sockeye salmon in the Kenai Peninsula account for approximately 14 percent of the ex-vessel value. The commercial salmon fishery also generates economic value for seafood processors, which is an important industry in some Pacific Coast regions. The salmon harvested along the Pacific Coast is processed into frozen, fresh, cured, and roe products. Although accurate information is not available for the Pacific Coast on the income generated by salmon for processors, processing of sockeye salmon harvested in the Cook Inlet of southcentral Alaska is estimated to increase the price paid for sockeye salmon by approximately 65 percent. Consumers of salmon also benefit from salmon harvested along

the Pacific Coast through price reductions resulting from of a greater supply of salmon and also from the availability of locally harvested salmon.

#### 3.4.3.7 Sport Salmon Fishery

Sport fishing for salmon is limited to hook-and-line gear and is conducted mostly from privately owned pleasure craft and charterboats. There is little shore-based angling in the ocean for salmon. Ocean recreational fishing licenses are required. Fee structures and specific licensing requirements vary among the three states. The three states also license commercial passenger fishing vessels (charterboats). Washington instituted a moratorium on the entry of new salmon charter vessels in 1977 and no provisions have been made to allow an expansion in the number of permits. Neither Oregon nor California limits entry to its charterboat fleet.

Ocean salmon angling is only one segment of a broader recreational market. There is competition with the British Columbia recreational industry for the dollars of Pacific Coast (U.S.) marine recreational anglers. Longer, more predictable ocean seasons have been the rule in Alaska and British Columbia than has been the case under the restrictive seasons of recent years on the Pacific Coast. Other types of angling and recreational activities are, to varying degrees, potential substitutes for ocean salmon fishing.

**Sport Harvest and Effort Trends**

Between 1976 and 1980, recreational salmon fishing trips averaged approximately 1.1 million coastwide. This level of effort excludes salmon trips in coastal rivers, where only very limited data are available. Before 1980, angler trips declined, averaging approximately 644,000 from 1981 to 1985. The number of angler trips increased slightly during the next 5-year period largely because of increased efforts in California.

As with commercial trolling, the majority of recreational effort (and harvest) has shifted to California south of Point Arena (south of Fort Bragg). During much of the 1970s, Westport, Washington, led other coastal ports in recreational salmon trips, averaging 210,000 trips annually between 1976 and 1980. Westport was followed by Ilwaco, Washington (on the Columbia River), Coos Bay, San Francisco, and Newport, all with 97,000 to 150,000 trips each. For the 1991-1995 period, San Francisco (464,000 angler trips) and Monterey (356,000 angler trips) lead all other ports, followed by Westport (179,000) and Ilwaco (148,000). From 1996 through 1997, angler trips totaled 215,000 in San Francisco and 149,000 in Monterey.

For 1988 to 1993 and 1994 to 1997, the recreational fishery tended to have a more stable harvest than the troll fishery in both absolute and relative terms; however, like the troll fishery, reduced fishing seasons caused substantial declines in recreational fisheries in recent years and marked fluctuations in season length in particular areas. From 1988 to 1993 there were approximately 532,000 angler trips per year compared to 323,000 from 1994 to 1997. Total sport salmon harvest averaged 575,000 fish from 1988 to 1993 and decreased to an average of 297,000 fish from 1994 to 1997. Chinook landings from 1988 to 1993 averaged 168,000, coho landings averaged 406,000, and pink salmon landings averaged approximately 12,000. From 1994 to 1997, chinook harvest averaged

252,000 chinook, coho harvest declined to approximately 44,000 coho, and pink salmon harvest declined to approximately 1,000 salmon.

Angler effort in California (234,300 angler trips) increased 4 percent in 1997 as compared to 1996, and effort in 1997 was 19 percent greater than the 1976 to 1996 average. Ocean recreational vessel-based trips in Oregon (30,400) declined 31 percent compared to 1996 trips. In 1997, 27,600 ocean angler trips took place on vessels in Washington, a decline of 29 percent from 1996 and the lowest effort level from 1979 to 1997, with the exception of 1994, when no fishing was allowed (Council 1998b).

**Ocean Sport Fishing-Related Businesses**

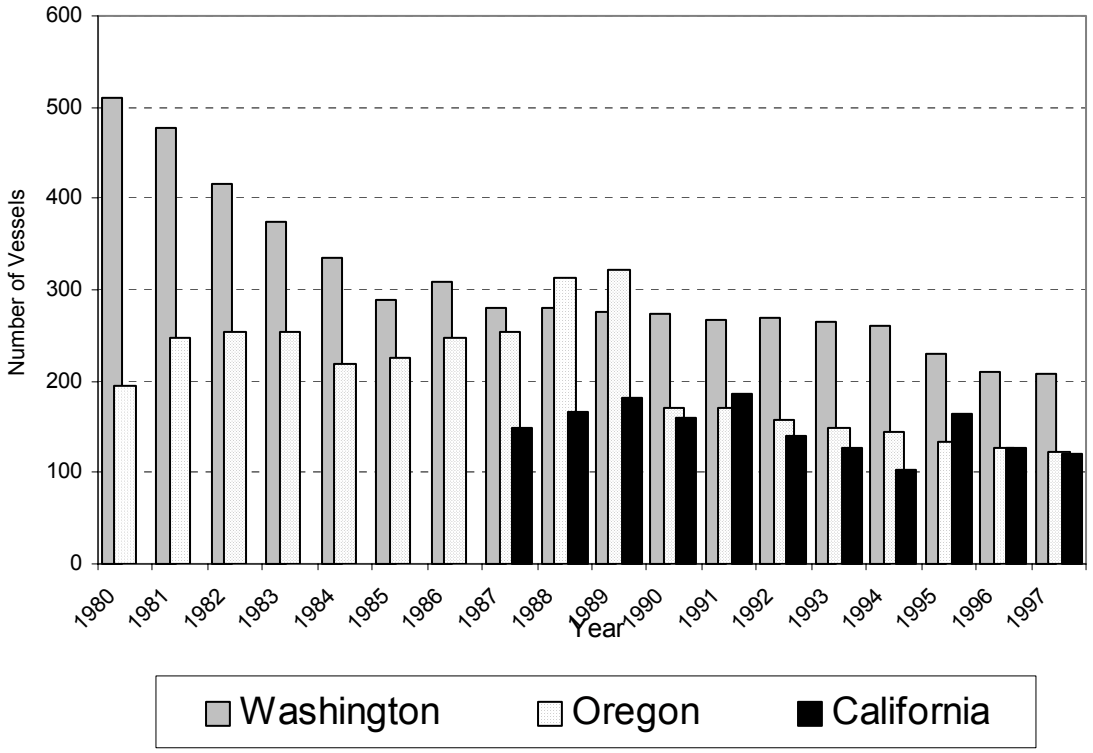
The number of charterboats licensed coastwide has declined substantially since the 1980s. Washington's fleet decreased from more than 500 boats to approximately 200 in 1997. Oregon's fleet declined from its peak of 313 boats in 1988 to 122 in 1997 (Figure 3.4-5). The number of charterboats actively participating in Oregon's salmon fisheries peaked in 1988 at 158, decreasing to 81 boats in 1994 and increasing slightly since then. In percentage terms, the largest declines in charterboat participation were in the Astoria and Winchester Bay area. The number of charterboats actively participating in salmon fisheries off California has been relatively more stable, fluctuating between 60 and 96 boats between 1987 and 1997 (Council, 1999b).

The majority of charter vessels along the Pacific Coast do not target salmon exclusively but have various strategies that include allocating parts of each season to trips for salmon, bottomfish, halibut, and tuna, depending on the length of salmon and halibut seasons, and the availability of tuna. More than 85 percent of the charter vessels in central and northern California target salmon. In Oregon, vessels that land salmon predominate in Astoria and Newport. Coos Bay, which was a leading port for salmon fishing until about 1990, has more recently accounted for a minor share of salmon fishing vessels in Oregon. Vessels that target bottomfish predominate in Garibaldi and Depoe Bay. Brookings vessels combine salmon and bottomfish while Gold Beach vessels target only salmon. In Washington, the most common strategy for charterboat operations is fishing for a combination of salmon, bottomfish, halibut, and tuna. Although some resorts rent small boats to anglers, their use is mostly limited to estuaries because of the frequently dangerous ocean bar crossings or other inclement ocean conditions encountered in traveling to ocean fishing grounds.

Other businesses affected by ocean sport fishing for salmon include marinas, lodging, food and beverage establishments, transportation service businesses, marine stores (boats and accessories), bait and tackle stores, general sporting goods stores, service stations, and miscellaneous retail trade stores. In 1996 revenues generated by ocean sport fishing for salmon at these types of businesses along the Pacific Coast totaled an estimated $25.9 million based on 308,300 trips.

### 3.4.3.8 Sport Fishery Economic Value

As described in Section 3.2.3.7, the economic value of the salmon sport fishery can be measured by the value the sport fishery generates for consumers and producers. Even though sport-caught salmon do not have a market price, the value to anglers can be




Source: Council, 1999, Appendix B

**Figure 3.4-5.** Number of recreational charter vessels in Washington, Oregon and California, 1980 to 1997.

measured by their WTP for fishing trips. WTP includes what anglers actually pay (i.e., angler spending) plus the additional amount that they would be willing to pay to continue sport fishing for salmon. As described in Section 3.3.3.7 angler spending associated with ocean sport fishing for salmon along the Pacific Coast was estimated at $25.9 million in 1996. Based on average values per trip from a study by Thomson and Huppert (1988), the net economic value (benefits) to anglers associated with ocean sport fishing for salmon in 1996 was an estimated $21.6 million. Anglers in California realized approximately 73 percent of these benefits.

The net economic value of the sport fishery to producers (e.g., charterboat operators, guides, and other sport fishing-related businesses) is measured by the net income (or profit) generated by sales to recreational anglers. Based on an average net income coefficient of 11.6 percent derived from IMPLAN for sport fishing-related businesses, the net income generated by ocean sport fishing for salmon in 1996 was estimated at $3.0 million. Sport fishing-related businesses in California received the largest share of this net income, estimated at approximately $2.2 million.

### 3.4.3.9 Fishing Communities

This section describes the affected environment to assess changes in economic and social conditions in potentially affected port communities and counties along the Pacific Coast. Additional information about fishing communities along the Pacific Coast can be found in

the "Community Descriptions" report recently prepared by the Council (1999a). The affected human environment is described for the most recent time frame for which data are consistently available, but reference is made to conditions in earlier years or changes over longer periods of time to the extent that they illustrate trends or tendencies important to the analysis.

**Regional Overview**

The Council management area extends from the United States-Canada border to central California, encompassing an area containing 13 counties and numerous port communities ranging from very small rural towns to the major metropolitan areas of San Francisco and Monterey counties (Figure 3.4-6). Fishers, processors, and others live and spend money in these communities, which to varying degrees are dependent on the salmon fishery. Although commercial fisheries of all types account for less than 5 percent of jobs in coastal counties, commercial fishing is an important base industry for many communities. Angling-related tourism, reflected mostly as part of economic activity in the service sector, is also important to many communities. Sport fishing, in particular salmon sport fishing, is one of the most popular recreations for coastal residents and those who visit the coast and, as such, is an important part of the culture and traditions of the region.

Over the last few decades, unemployment rates in the coastal communities have generally exceeded those of metropolitan areas and statewide averages, and growth in per capita income has not kept pace with either state or metropolitan areas. Personal income in coastal communities associated with salmon fisheries has declined as have community income effects. From 1976 to 1996 total state level income associated with the recreational and troll ocean fisheries for all three states combined averaged $138.1 million (adjusted for inflation). In 1997 state level income was $50.5 million. Relatively greater reductions have occurred in many communities, particularly in the KMZ (Eureka, Crescent City, and Brookings) and north of Cape Falcon (Astoria, llwaco, Westport, La Push, and Neah Bay) (Council 1999a). Estimated state income effects of commercial and recreational ocean salmon fisheries for Pacific Coast fisheries are shown in Figure 3.4-7. Income figures are estimates of annual trends and the possible redirection of money between non-fishing-dependent and fishing-dependent sectors. In addition, they are likely an upper bounds on the state income effects that may have been generated by Pacific Coast ocean salmon fisheries as well as some selected inside fisheries (Council 1999a).

The most important port areas for the recreational and commercial fleets are Neah Bay, La Push, Westport, and Ilwaco, Washington; Astoria, Garibaldi, Newport, Coos Bay, and Brookings, Oregon; and Crescent City, Eureka, Fort Bragg, San Francisco, and Monterey, California. Neah Bay, La Push, and Ilwaco are single port areas. The Westport area is comprised of the ports of Westport, Ocean Shores, and Aberdeen. The Astoria port area includes harbors in Warrenton and Hammond, the Garibaldi area includes the Port of Tillamook and Pacific City, and Newport includes the Port of Depoe Bay. The Coos Bay port area includes Florence, Winchester Bay, Charleston, and Waldport. The San Francisco port area includes Bodega Bay, and the Monterey port area includes Moss Landing. The socioeconomic character and dependence of the port communities on salmon fisheries varies with community size, diversity of industry, location in relation to trade and tourist routes, and other factors. Table 3.4-4 summarizes some of these factors for each community.

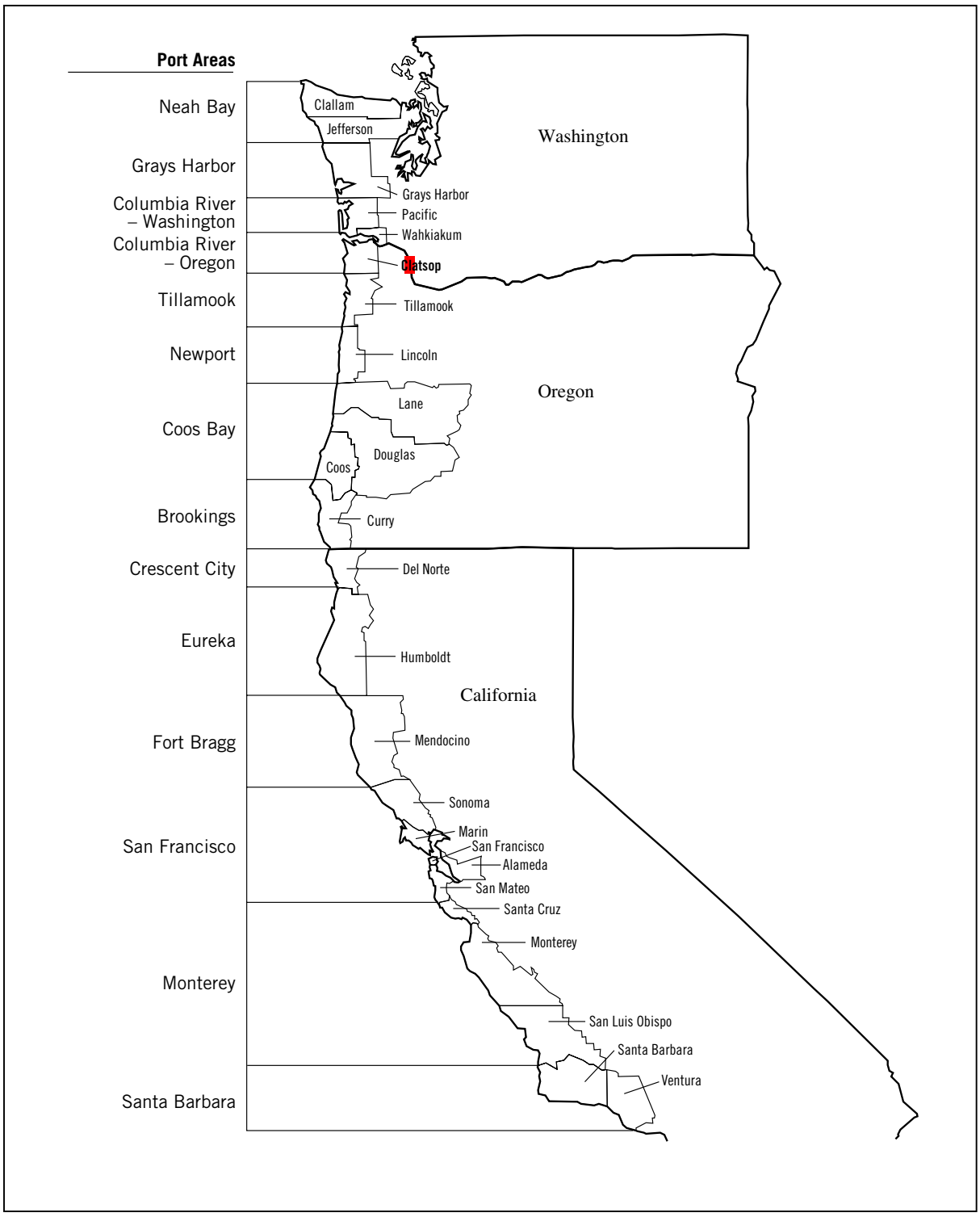
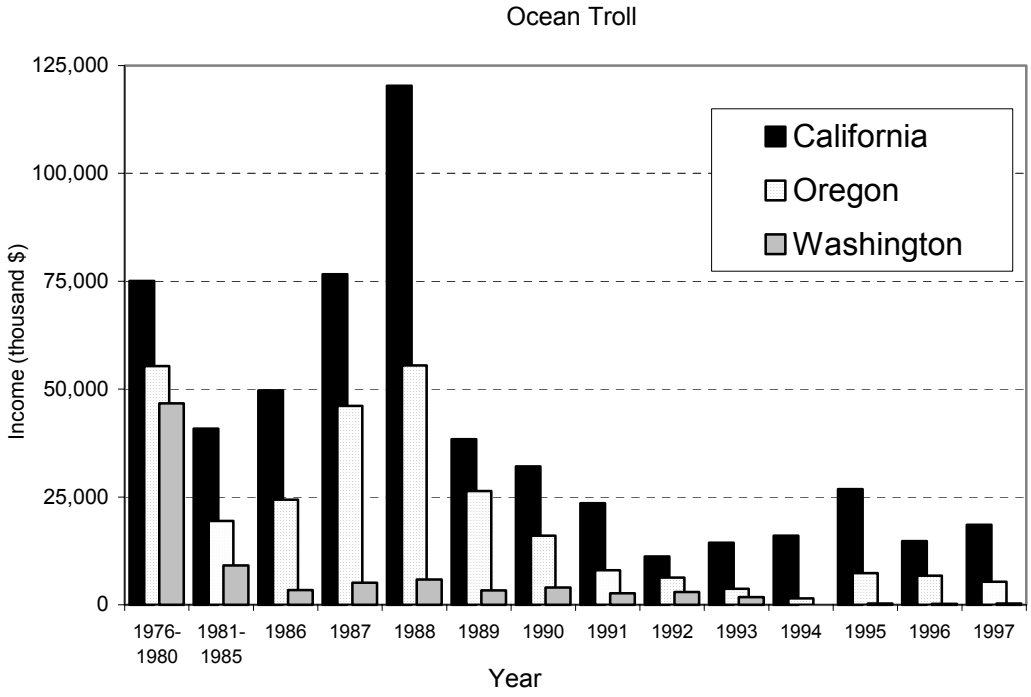
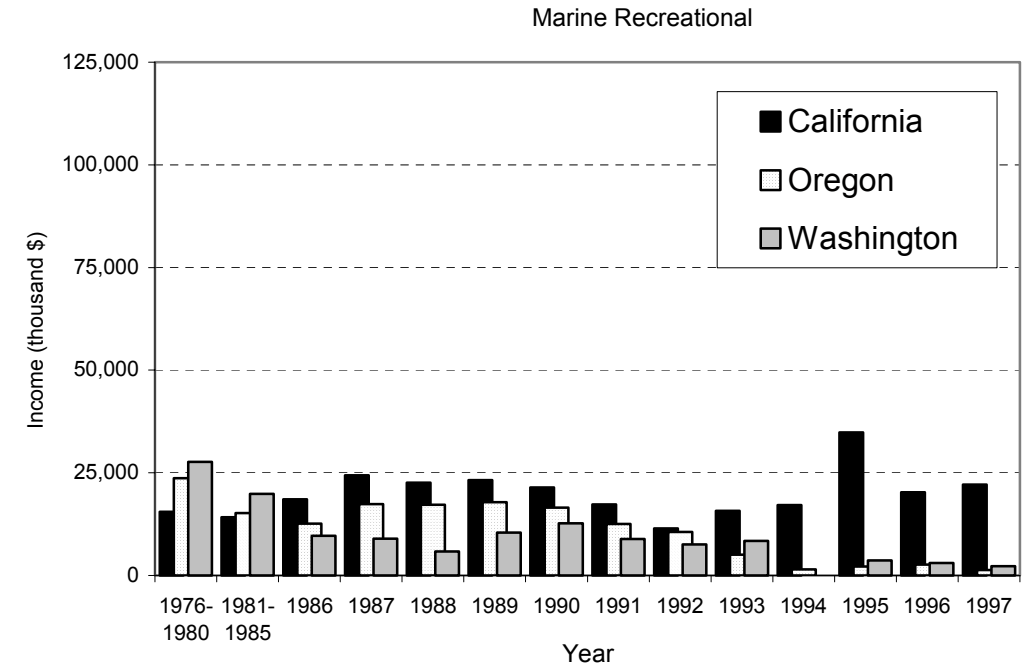



**Figure 3.4-6.** Counties and communities within the Council management area.




Notes: Expressed in 1997 dollars. Per pound and per day estimates of income effects provided from output of the Fishery Economic Assessment Model. These are income effects associated with expenditures in the troll or recreational sectors. There is no differentiation between money new to the area and money that would otherwise have been expended in other sectors.
Source: Council 1999a.

**Figure 3.4-7.** Income effects of ocean troll and marine recreational fisheries, 1976 to 1997.

**Table 3.4-4.** Description of port areas and profiles of fishing communities in the Council management area.

| Port Area | Geographical Description | Principal Ports for Commercial Salmon Landings | Description of Primary Ports | Commercial Salmon Fleet and Trends | Sport Facilities and Trends |
|---|---|---|---|---|---|
| Neah Bay | Clallam County South from Neah Bay and Jefferson County | Neah Bay, La Push | Neah Bay: Formerly an important troll and sportfishing port, Neah Bay, located near the northwest tip of Washington, is the center of Makah Tribal Nation. The Makah's are active in ocean troll fisheries. Located at the terminus of a secondary highway, Neah Bay is relatively remote and lacks a well-developed tourist trade.<br><br>La Push: The center of the Quileute Tribal Nation, La Push is a small port located at the mouth of the Quileute River, approximately 30 south of Cape Flattery, WA. The Quileute tribe is active in ocean troll fisheries. Formerly an important non-tribal trolling and sport fishing port, La Push is located at the terminus of a secondary highway, is relatively remote, and lacks a well-developed tourist trade. | Neah Bay: 20 non-tribal boats landed salmon in 1997 compared to 50 in 1988. Tribal troll effort is unknown.<br><br>La Push: 1 non-tribal boat landed salmon in 1997. Tribal effort is unknown. | Neah Bay: The number of resorts has declined from 6 to 2. 1-3 charterboats operate, depending on the season. |
| Grays Harbor | Grays Harbor County | Taholah, Aberdeen, Westport | The Westport/Ocean Shores area at the entrance to Grays Harbor has historically depended on fishing-related tourism and commercial fishing. Located at the terminus of a secondary highway, it is relatively remote. However, major resort, condominium and real estate developments have diversified the tourism industry, and the port is used by a variety of commercial fishing vessels. | 26 non-tribal boats landed salmon in 1997 compared to 327 in 1988. | 30 charter boats in 1997 compared to 50 in 1988 and 230 in 1977. |
| Columbia River-Washington | Pacific and Wahkiakum Counties | Tokeland, Southbend, Bay Center<br>Ilwaco, Chinook | Ilwaco, located on the north shore of the Columbia River estuary, has traditionally depended on sport and commercial ocean salmon fishing. A small port, difficult to access by larger vessels, it is infrequently used by the commercial trawl fleet. Located at the terminus of a secondary highway, it is relatively remote. Although it is located near a major tourism center (Long Beach), Ilwaco's tourist industry remains largely dependent on fishing. | No boats landed salmon in 1997 compared to 69 in 1988. | 20 charterboats operated in 1997. |
| Columbia River-Oregon | Clatsop County | Astoria | Located on the south shore of the Columbia River estuary, the Astoria-Warrenton-Hammond part area has a diverse commercial fishing fleet, including salmon, crab, groundfish, and shrimp fishing vessels. | Presently 30-40 vessels that fish salmon or a combination of salmon, crab, and blackcod operate from this port. Salmon trolling activity from this port has ranged from none to a few hundred vessel-days since 1988. | There were approximately 30 active charterboats in 1995, down from a peak of 50 in 1987. |

**Table 3.4-4.** Description of port areas and profiles of fishing communities in the Council management area (continued).

| Port Area | Geographical Description | Principal Ports for Commercial Salmon Landings | Description of Primary Ports | Commercial Salmon Fleet and Trends | Sport Facilities and Trends |
|---|---|---|---|---|---|
| Tillamook | Tillamook County | Tillamook, Garibaldi, Pacific City | Located on the coast of Oregon approximately 50 miles southwest of Portland, Tillamook/Garibaldi is a relatively small port infrequently used by larger commercial fishing or other vessels. | There are fewer than 40 salmon vessels currently. Salmon trolling activity is currently less than 1,500 vessel-days compared to a peak of 10,500 vessel-days in 1988. | 15 active charterboats in 1995 compared to a peak of 24 in 1988. |
| Newport | Lincoln County | Depoe Bay, Newport | Commercial fishing for a variety of species is an important part of Newport's economy, and this port has several fish processing plants and one major shipyard. There are approximately 231 commercial fishing vessels of all kinds. Located along Highway 101, Newport and Depoe Bay, a smaller, sport-oriented port to the north, benefit from large volumes of tourist traffic and a diversified tourism industry. Forest products are also an important part of the area's economy. | There are 40-50 boats that troll for salmon. Effort is currently less than 6,000 vessel-days annually compared to a peak of 12,500 days in 1988. | 40 active charterboats in 1995 compared to a peak of 57 in 1990. |
| Coos Bay | Lane, Douglas and Coos Counties | Florence, Winchester Bay, Charleston, Bandon | Coos Bay is home port for a variety of commercial fishing operations supporting a fleet of approximately 250 vessels, as well as a major forest products processing and shipping center. | There are 35-40 salmon trollers. Effort is currently less than 2,000 vessel-days annually compared to a peak of 26,300 in 1989. | 2 active charterboats in 1995 compared to a peak of 18 in 1986. |
| Brookings | Curry County | Port Orford, Brookings | Brookings has a fleet of approximately 400 commercial fishing vessels of all kinds. Its tourism industry benefits from its location along Highway 101. | There are 10-20 salmon trollers. Effort is currently less than 500 vessel-days compared to a peak of 1,400 in 1988. | 6 active charterboats in 1995 compared to a peak of 18 in 1986. |
| Crescent City | Del Norte County | Crescent City | Crescent City has a diverse fishing fleet numbering approximately 100 vessels. | There are 15-20 salmon trollers. There were 6 vessel deliveries in 1997 compared to 320 in 1988. | No charterboats were operating in 1995 compared to a peak of 4 in 1987. |

**Table 3.4-4.** Description of port areas and profiles of fishing communities in the Council management area (continued).

| Port Area | Geographical Description | Principal Ports for Commercial Salmon Landings | Description of Primary Ports | Commercial Salmon Fleet and Trends | Sport Facilities and Trends |
|---|---|---|---|---|---|
| Eureka | Humboldt County | Eureka, Field's Landing | Eureka's fishing fleet numbers upwards of 75 vessels, primarily focused on bottomfish and crab. | There are approximately 30 salmon trollers licensed. There were 104 vessel deliveries in 1997 compared to 4,139 in 1988. | 1 active charterboat in 1995 compared to a peak of 11 in 1989. |
| Fort Bragg | Mendocino County | Fort Bragg | Approximately 20-25 shrimp and groundfish trawlers operate out of Fort Bragg. | There are 25-30 salmon trollers. There were 272 vessel deliveries in 1997 compared to 1,4250 in 1988. | 5 active charterboats in 1995 compared to peak of 8 in 1988. |
| San Francisco | Sonoma, Marin, San Francisco, Alameda, and San Mateo Counties | Bodega Bay, Sausalito, San Francisco, Princeton | Increased industrial and tourist use of the Port of San Francisco has displaced much of the commercial fleet to other nearby ports, including Bodega Bay to the north. A fleet of approximately 30 trawl vessels operates out of Bodega Bay. | Approximately 100 salmon trollers operate out of San Francisco and up to 50 out of Bodega Bay. 3,140 vessel deliveries in 1997 compared to 22,420 in 1988. | There were 47 active charterboats in 1995 compared to a peak of 62 in 1987. Up to 10 of these are based in Bodega Bay. |
| Monterey | Santa Cruz, Monterey, and San Luis Obispo Counties | Santa Cruz, Moss Landing, Monterey, Morro Bay, Avila | Tourism is an important component of the economies of all ports within the Monterey port area due to the area's scenic beauty and accessibility. Thus, the number of charterboats active in salmon fishing has remained fairly constant in recent years, peaking at 40 in 1995. The volume of commercial salmon landings is relatively large at Santa Cruz, Moss Landing, and Monterey. | 6,869 vessel deliveries in 1997 compared to 11,564 in 1988. | 40 active charterboats in 1995, the highest number over the 1987-97 period. |
| Santa Barbara | Santa Barbara and Ventura Counties | Santa Barbara | Tourism is a major component of the Santa Barbara area's economy. Commercial salmon deliveries at Santa Barbara have been relatively low compared to major ports in the central and northern parts of California. | 789 commercial vessel deliveries in 1996 compared to 470 in 1994. | For sport fishing, Santa Barbara trend data is included in Monterey port area data. |

**Population Characteristics**

The total population within the coastal counties that comprise the Council management area was 1.47 million in 1980, 1.62 million in 1990, and 1.69 million in 1998. The growth rate was 10 percent from 1980 to 1990 and 4 percent from 1990 to 1998. The 13 counties in the Council management area are Clallam, Grays Harbor, and Pacific, Washington; Clatsop, Tillamook, Lincoln, Coos, and Curry, Oregon; and Del Norte, Humboldt, Mendocino, San Francisco, and Monterey, California (Figure 3.4-6). Populations of counties within the region range from relatively small, rural counties such as Curry County, Oregon, (27,000 residents) to metropolitan (San Francisco County [745,000 residents]). The Falcon-KMZ area in southern Oregon is the most sparsely populated community of the Council management area, containing approximately 8 percent of the total residents. The South of KMZ management area, stretching from Fort Bragg to Monterey, contains approximately 80 percent of the Pacific Coast population.

Population growth has varied considerably among the counties. Those with an increase in population of 10 percent or less from 1980 to 1990 included Clallam and Pacific counties in Washington, Clatsop and Tillamook counties in Oregon, and Humboldt and San Francisco counties in California. Population increases of 11 to 20 percent occurred in Curry and Lincoln counties, Oregon, and increases of 21 percent or more occurred in Del Norte, Mendocino, and Monterey counties in California. Grays Harbor County, Washington, and Coos County, Oregon, experienced minor declines from 1980 levels. By 1998 growth had substantially slowed for some counties while other counties experienced an increase in population growth (Table 3.4-5). Seven counties experienced a population growth of 10 percent or less, including Clatsop and Coos counties, Oregon; Grays Harbor County, Washington; and Humboldt, Mendocino, Monterey, and San Francisco counties, California. Moderate increases (11 to 20 percent) occurred in Clallam and Pacific counties, Washington; Curry and Lincoln counties, Oregon; and Del Norte County, California. None of the counties experienced population declines from 1990 to 1998.

**Employment, Income, and Poverty Levels**

Distribution of employment among industry sectors for Pacific Coast counties is similar. The service sector accounts for 20 to 30 percent of jobs in Washington and Oregon counties and 30 to 40 percent in California counties (Table 3.4-6). Wholesale and retail trade was the second largest sector, employing approximately 25 percent of the workforce in Washington and Oregon counties and 18 percent in California counties. Government was the third largest employer, accounting for approximately 15 percent of jobs. Sectors accounting for 10 percent or less of the labor force included real estate, insurance, and financial services (10 percent); manufacturing (7 percent); and agriculture, forestry, and fisheries (5 percent or less). (Note: Unless otherwise noted, employment, income, and other values are U.S. Bureau of Census estimates for 1996.) In general, unemployment rates in coastal counties exceed statewide unemployment rates. In Washington, Oregon, and California, coastal counties averaged 10.7 percent unemployment compared to a statewide unemployment rate of 6.5 percent, 7.7 percent compared to 5.4 percent unemployment statewide, and 9.8 percent compared to 8.6 percent unemployment statewide, respectively (Table 3.4-6).

**Table 3.4-5.** Key population and income statistics for counties in the Council management area.

| State | County | Population | | % Change | Per Capita Income | % Below Poverty |
|---|---|---|---|---|---|---|
| | | 1990 | 1998 | | | |
| Washington | Clallam County | 56,464 | 66,700 | 18.1 | $20,076 | 12.1 |
| | Grays Harbor County | 64,175 | 67,900 | 5.8 | $18,167 | 16.4 |
| | Pacific County | 18,882 | 21,500 | 13.9 | $17,300 | 15.5 |
| Subtotal/Average | | 139,521 | 156,100 | 11.9 | $18,514 | 14.7 |
| Oregon | Clatsop County | 33,301 | 34,700 | 4.2 | $19,472 | 13.4 |
| | Tillamook County | 21,570 | 24,000 | 11.3 | $17,058 | 13.2 |
| | Lincoln County | 38,889 | 43,200 | 11.1 | $18,544 | 14.6 |
| | Coos County | 60,273 | 61,400 | 1.9 | $17,890 | 17.8 |
| | Curry County | 19,327 | 22,000 | 13.8 | $18,855 | 15.1 |
| Subtotal/Average | | 173,360 | 185,300 | 6.9 | $18,364 | 14.8 |
| California | Del Norte County | 23,460 | 27,000 | 15.1 | $14,532 | 19.6 |
| | Humboldt County | 119,118 | 122,262 | 2.6 | $18,580 | 17.0 |
| | Mendocino County | 80,345 | 83,734 | 4.2 | $19,256 | 16.9 |
| | San Francisco County | 723,959 | 745,774 | 3.0 | $35,915 | 12.3 |
| | Monterey County | 355,660 | 365,605 | 2.8 | $24,394 | 9.5 |
| Subtotal/Average | | 1,302,542 | 1,344,375 | 3.2 | $22,535 | 15.1 |
| **TOTALS** | | **1,615,423** | **1,685,755** | **4.4** | **$20,003** | **14.9** |

Source: U.S. Census Bureau 1999.

Annual per capita personal income for the coastal counties averaged $18,514 in Washington, $18,364 in Oregon, and $22,535 in California (Table 3.4-5). Differences among counties in Washington and Oregon were minor, but per capita income in California varied from a low of $14,532 in rural Del Norte County to $35,915 in San Francisco County. Poverty levels among the coastal counties were similar for all three states and substantially higher than poverty levels for the states as a whole. Poverty levels were 14.7 percent in Washington coastal counties compared to 10.8 percent statewide, 14.8 percent in Oregon coastal counties compared to 12.5 percent statewide, and 15.1 percent in California coastal counties compared to 8.6 percent statewide (Table 3.4-5).

### 3.4.3.10 Social Characteristics of Commercial Fleet

Trolling became economically important after World War II. Because fixed and variable costs were relatively low compared to some other fisheries, trolling became an entry level fishery for many who later diversified into other forms of fishing, including trawling. The common practice of fishing for salmon, crab, and albacore served to buffer declines in bad seasons or in one of the fisheries. In addition to full-time trollers, many people with flexible jobs, such as teaching or service industry work, fished part-time. Many retirees also augmented their income through trolling or pursued trolling as a way to keep busy or as a pleasurable activity (Gilden and Smith 1996).

**Table 3.4-6.** Distribution of employment by major industry sector in 1996 for Pacific Coast counties.

| Management Area/State/County | Port | Agriculture, Forestry & Fisheries | Mining & Construction | Manufacturing | Trans., Comm., & Other Util. | Wholesale/ Retail Trade | Finance, Insurance, Real Estate | Services | Government | Labor Force | Unemployment Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Canadian Border to Cape Falcon Management Area** | | | | | | | | | | | |
| WASHINGTON | | | | | | | | | | | |
| Clallam County | Neah Bay, LaPush | 2.9% | 6.7% | 9.5% | 3.7% | 23.2% | 7.2% | 27.6% | 19.1% | 29,718 | 9.7% |
| Grays Harbor County | Westport | 4.2% | 5.6% | 17.4% | 4.5% | 24.5% | 0.0% | 25.9% | 17.8% | 29,269 | 11.8% |
| Pacific County | Willapa Bay, Ilwaco | 9.5% | 4.5% | 15.0% | 2.1% | 20.2% | 6.1% | 23.0% | 19.4% | 8,969 | 10.5% |
| OREGON | | | | | | | | | | | |
| Clatsop County | Astoria | 5.3% | 5.3% | 15.2% | 3.1% | 25.7% | 4.1% | 27.1% | 14.2% | 20,867 | 6.3% |
| **SUBTOTAL** | | **4.6%** | **5.8%** | **14.0%** | **3.7%** | **23.9%** | **4.0%** | **26.5%** | **17.5%** | **88,823** | **9.6%** |
| **Cape Falcon to Klamath Management Area (Oregon)** | | | | | | | | | | | |
| Tillamook County | Tillamook, Garibaldi | 4.6% | 5.8% | 12.3% | 4.1% | 24.8% | 5.2% | 27.3% | 16.0% | 10,842 | 6.0% |
| Lincoln County | Newport | 5.0% | 5.6% | 7.3% | 3.0% | 27.5% | 6.3% | 30.2% | 15.1% | 24,051 | 7.5% |
| Coos County | Coos Bay | 3.8% | 4.7% | 12.1% | 6.0% | 22.9% | 4.9% | 27.2% | 18.3% | 29,768 | 9.2% |
| **SUBTOTAL** | | **4.4%** | **5.2%** | **10.3%** | **4.6%** | **24.9%** | **5.5%** | **28.3%** | **16.7%** | **64,661** | **7.6%** |
| **Klamath Management Area** | | | | | | | | | | | |
| OREGON | | | | | | | | | | | |
| Curry County | Port Orford, Brookings | 5.7% | 7.4% | 9.9% | 3.9% | 27.1% | 6.3% | 25.3% | 14.4% | 8,891 | 9.6% |
| CALIFORNIA | | | | | | | | | | | |
| Del Norte County | Crescent City | 6.7% | 3.6% | 5.3% | 3.4% | 22.3% | 3.8% | 26.3% | 28.6% | 10,193 | 12.0% |
| Humboldt County | Eureka | 3.5% | 5.4% | 12.4% | 3.9% | 23.0% | 5.8% | 30.3% | 15.7% | 67,068 | 8.8% |
| **SUBTOTAL** | | **4.1%** | **5.4%** | **11.3%** | **3.9%** | **23.3%** | **5.6%** | **29.3%** | **17.1%** | **86,152** | **10.1%** |
| **South of Klamath Management Area (California)** | | | | | | | | | | | |
| Mendocino County | Fort Bragg | 7.1% | 7.3% | 17.4% | 4.2% | 3.2% | 6.9% | 37.7% | 16.2% | 36,712 | 9.7% |
| San Francisco County | San Francisco | 0.4% | 2.8% | 5.5% | 6.1% | 16.9% | 12.7% | 42.0% | 13.5% | 703,455 | 6.7% |
| Monterey County | Monterey | 13.6% | 4.2% | 5.5% | 3.4% | 21.0% | 6.7% | 28.1% | 17.4% | 182,986 | 11.9% |
| **SUBTOTAL** | | **3.3%** | **3.3%** | **6.0%** | **5.5%** | **17.2%** | **11.3%** | **39.1%** | **14.4%** | **923,153** | **9.4%** |
| STATE SUBTOTALS | | | | | | | | | | | |
| WASHINGTON | | 4.4% | 6.0% | 13.7% | 3.9% | 23.4% | 4.0% | 26.3% | 18.6% | 67,956 | 10.7% |
| OREGON | | 4.7% | 5.5% | 11.4% | 4.2% | 25.3% | 5.3% | 27.8% | 15.9% | 94,419 | 7.7% |
| CALIFORNIA | | 3.3% | 3.4% | 6.4% | 5.4% | 17.6% | 10.8% | 38.4% | 14.6% | 1,000,414 | 9.8% |
| **TOTALS** | | **3.5%** | **3.7%** | **7.3%** | **5.2%** | **18.6%** | **10.0%** | **36.8%** | **15.0%** | **1,162,789** | **9.2%** |

Notes: "0" values are reported for confidentiality.
Category totals may not account for subcomponents of each labor sector category where figures were omitted for confidentiality.

Source: Oregon State University Government Information Sharing Program, Regional Economic Information System, 1969-1997, U.S. Bureau of Census, Oregon Economic & Community Development Department, Idaho Department of Labor

Although salmon trolling remains an important part for the culture for some coastal communities, the number of active commercial salmon trollers is now only approximately 10 percent of its peak of 11,000 in 1978. A recent survey of Oregon trollers found approximately 41 percent of respondents were full-time fishers for whom salmon trolling was one of several fisheries in which they participated, including albacore trolling, crabbing, halibut, and black cod longlining. Approximately 24 percent of the respondents were retirees and 35 percent had other jobs in addition to fishing. Salmon trolling provided less than 1 percent of total income for the retirees and part-time fishermen and 12 percent for the full-time fishermen. Only 8 percent earned half or more of their income from salmon trolling. The average age of full-time fishers was 53; part-time fishers, 52; and retirees, 67 (Gilden and Smith 1996).

### 3.4.3.11 Characteristics of Tribal Communities

There are seven federally recognized Tribes in the Council management area: Makah, Quileute, Hoh, and Quinault in Washington; and the Yurok, Hoopa, and Round Valley Tribes in California. The Makah, Quileute, and Hoh Tribes have active commercial troll fleets (Phil Anderson, WDFW, personal communication). The remaining Tribes practice commercial and ceremonial and subsistence fisheries in freshwater. It should be noted that whether or not Tribes are actively engaged in trolling, they are entitled under treaty to troll; restrictions imposed on ocean fisheries would affect this treaty right.

**Hoh**

The Hoh River Tribe is considered a band of the Quileutes but is recognized as a separate Tribe. The Hoh Reservation, established by Executive Order in 1963, consists of 443 acres located 28 miles south of Forks, Washington, and 80 miles north of Aberdeen, Washington. There are 212 enrolled Tribal members. There are 20 FTE employees of the Tribe. The livelihood of the Hoh is primarily fishing although a few of the residents make traditional decorative baskets, carved canoes for ocean going or river use, and other decorative carvings. The local people dip for smelts on the beaches and still use smokehouses for preserving food for future use. The tidelands have abundant razor clams, butter clams, and crab (Hoh Tribal Web Site 2000).

**Makah**

The Makah Reservation consists of 27,200 acres of land at the northwest tip of Washington's Olympic Peninsula, bounded by the Pacific Ocean and the Strait of Juan de Fuca. The Reservation is extremely isolated from other communities within Clallam County, the Olympic Peninsula, and Washington State in general. Clallam County's major commercial center and county seat, Port Angeles, is 75 miles from Neah Bay, which is a commercial fishing and timber community, as well as a tourist and sport fishing destination. Seattle is 225 miles away and Forks, the closest city center, is 60 miles away. Tribal enrollment is approximately 2,195 and local housing is available for Tribal members. Tribal employment is 90 full-time equivalents (FTEs).

Makah are maritime people who use fish and shellfish and hunt whale. The Makah Tribe is part of the Nootkan culture group, which includes the West Coast and Nitinaht Tribes of

Western Vancouver Island, British Columbia. Historically, Makah have had a highly developed representational art style, a stratified social order, and a specialized labor force.

Rocky headlands and sandy beaches typify the shoreline of the Reservation. There is one large harbor protected by a breakwater at Neah Bay proper, the central village of the Reservation. The Reservation acreage is dominated mainly by rugged mountains with elevations typically between 500 and 1,000 feet and reaching nearly 2,000 feet at Sooes Peak. Four major watersheds drain the main Reservation areas through the Sail, Waatch, Hoko and Sooes rivers. The floodplains of the Waatch and Sooes rivers contain the only flat land within the Reservation and are used for livestock grazing. More than 1,000 acres of the land bordering the Pacific Ocean have been reserved as a Wilderness Area. Other reserved areas include land around Hobuck Lake, an area of the forest set aside as a reserve for cedar trees; the entire 719-acre Ozette Reservation; and Tatoosh and Waadah islands. The remaining land is managed intensively for the production of forest products (Makah Tribal Web Site 2000).

**Quilleute**

Surrounded on three sides by The Olympic National Park, the Quileute Reservation is located on 594 acres along the Pacific Coast and on the south banks of the Quillayute River (formed by the Sol Duc, Bogachiel, and Dickey rivers). The enrolled population is reported to be 706, and the American Indian population living on or near the Reservation totals 784. More than 40 percent of the population is less than 19 years of age and 2 percent of the population is more than 65 years. The Tribe employs approximately 55 persons in administration and 25 as teachers or school administrators. There are approximately nine private businesses (Northwest Portland Area Indian Health Board).

**Quinault**

The Quinault Reservation is 189,621 acres and is located in northwestern Grays Harbor County and southwest Jefferson County, 45 miles north of Hoquiam. Historically, salmon and steelhead fishing were the major economic activities of the Quinault and the rich supply of timber also played an important part in their lifestyle. The 2,453-member Tribe is governed by an 11-member business committee that meets with officers of the General Council. This committee functions under a set of by-laws that the Tribe adopted on August 24, 1922. Tribal infrastructure and businesses include offices of Economic Development and Natural Resources, a seafood processing plant, Quinault Timber Enterprises, Quinault Construction, two retail stores, and a restaurant. The Tribe employs 252 persons full time with approximately 57 temporary or seasonal workers (Northwest Portland Area Indian Health Board).

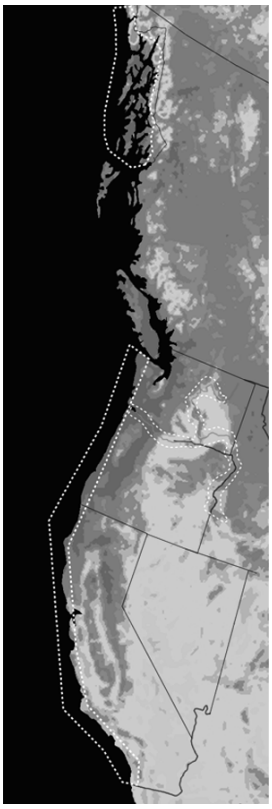
**Klamath**

Klamath Tribes consist of Klamath, Modoc, and Yahooskin Bands of Snake Indians. Historically, these Tribes claimed the east slopes of the Cascades and the adjoining desert areas from the Deschutes River headwaters in the north to Mt. Shasta in California to the south. All of these areas are located above dams that block anadromous fish passage. The Tribal lifestyle was hunting and gathering. The Klamath people were placed on a 1.1-million-acre reservation in the 1860s. Encroachments later led to the infamous Modoc War

of 1873. The Klamath Tribe was subsequently terminated in 1954 by the U.S. Government. After many years of persistent lobbying, Tribal leaders were finally able to have this termination revoked through passage of PL 99-398, the Klamath Indian Tribe Restoration Act, in August 1986. There are approximately 3,175 Tribal members; approximately 38 percent live in the Chiloquin area, 11 percent live in Beatty, and 51 percent live in the Klamath Falls area. Tribal administration employs approximately 64 people full time and the Tribal health organization employs 48 (Northwest Portland Area Indian Health Board).

# 3.5 Columbia River Basin

## 3.5.1 Physical Environment



The Columbia River is the largest river on the West Coast of North America, draining approximately 261,000 square miles and extending across five ecoregions (Myers et al. 1998). Annual precipitation west of the Cascade Mountains is relatively high and seasonal air temperatures are relatively moderate, whereas annual precipitation east of the mountains is low and seasonal temperatures are more extreme.

Historically, flows in the Columbia River ranged from 49,000 to 989,000 cubic feet per second, depending primarily on glacial and snow melt. Construction of numerous dams and the associated water storage capacity has resulted in present flows of approximately 124,000 to 350,000 cubic feet per second (Williams and Tuttle 1992). Approximately 136 hydroelectric and multipurpose dams are operated within the historical limits of anadromous fish runs. These facilities have a storage capacity of approximately 74.9 million acre-feet, which is equivalent to approximately 56 percent of the average annual modified runoff of the Columbia River at The Dalles, Oregon. Approximately 10 million acre-feet of Columbia River water are delivered to farms (1980s estimate). In addition to altering the seasonal flow regime, dams have altered temperature, dissolved oxygen, and dissolved nitrogen parameters. The mainstem Columbia River is now a series of pools with greatly reduced velocities, except for the Hanford Reach downstream from Priest Rapids Dam and the reach below Bonneville Dam (Figure 3.5-1). Major tributaries include the Snake, Willamette, Cowlitz, Deschutes, Yakima, and Wenatchee rivers. Major tributaries of the Snake River include the Clearwater, Salmon, and Grande Ronde rivers.

Total anadromous fish habitat in the Columbia River basin was approximately 163,000 square miles of drainage area before dam construction. Today, approximately 56 percent, or 73,000 square miles, of accessible habitat remains (Fulton 1968, 1970; Thompson 1976). Dams blocking access to significant anadromous fish habitat include Chief Joseph in the Upper Columbia River, Brownlee Dam on the Snake River, Dworshak on the North Fork Clearwater, Mayfield Dam on the Cowlitz, Pelton/Round Butte complex on the Deschutes River, and several dams in the Willamette watershed (Palmisano et al. 1993).

## 3.5.2 Biological Environment

### 3.5.2.1 Salmonid Species

Most salmon and steelhead stocks in the Columbia River basin are severely depressed; four steelhead ESUs are listed as threatened and one ESU (Upper Columbia River Steelhead) is listed as endangered. Four of the seven chinook ESUs are listed as threatened and one ESU is listed as endangered (Upper Columbia River Spring Chinook). Native coho runs to the

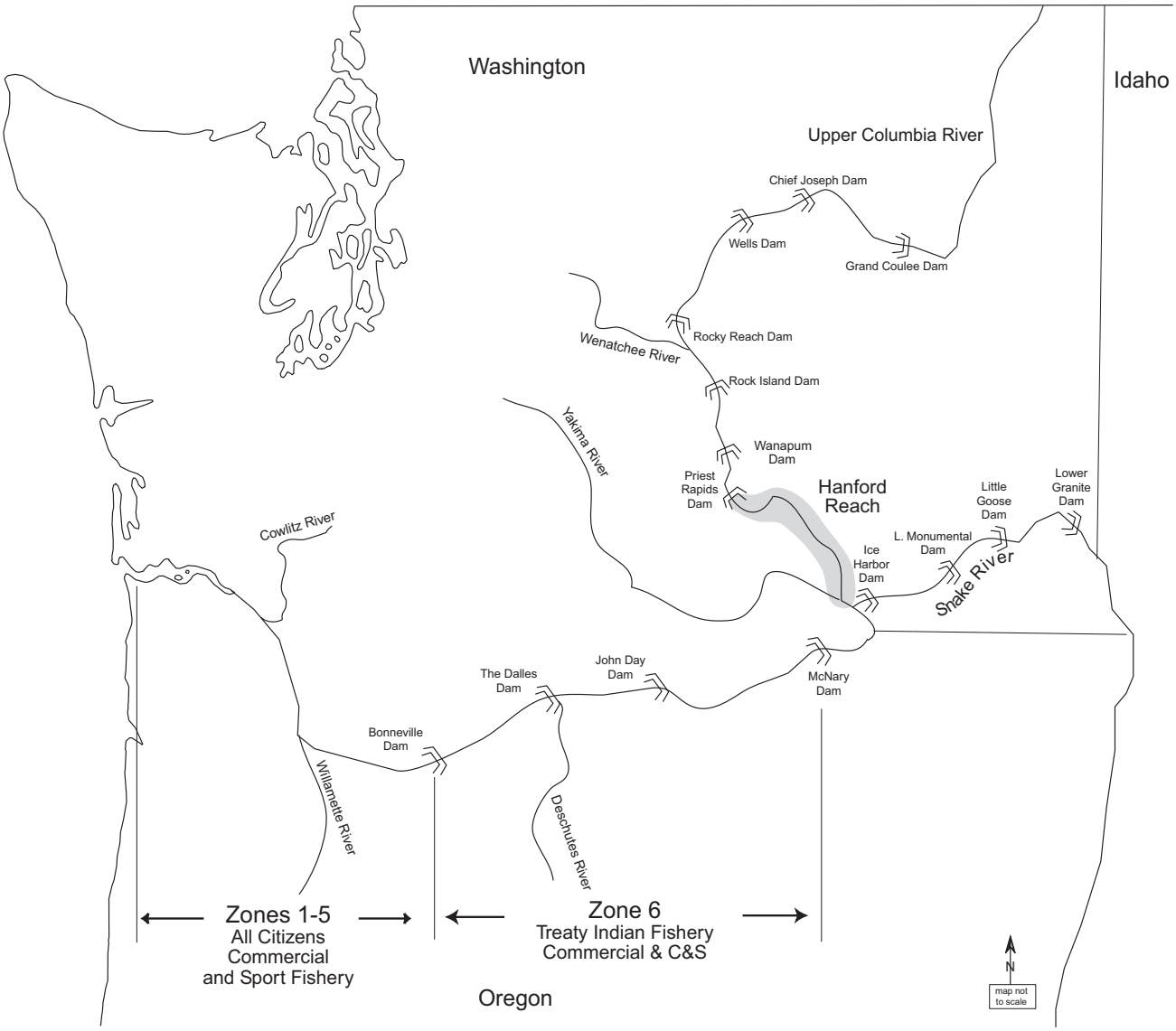



**Figure 3.5-1.** Location map of the affected area on the Columbia River.

middle and upper Columbia River basin are extinct (Mullan 1984). Lower Columbia River coho are a candidate species and are therefore under review by NMFS. Chum salmon from lower river tributaries are listed as threatened. Sockeye salmon returning to the Snake River basin (Snake River ESU) are endangered but other sockeye stocks (primarily upper Columbia River) are not listed. Pink salmon do not maintain runs to the Columbia River. The status of listed stocks is discussed in Section 3.4.2.2. Recently, fisheries in the Columbia River basin have rarely targeted wild salmon and steelhead stocks; the primary exceptions are Hanford Reach chinook (fall run) and other components of the Upper Columbia River fall chinook run (e.g., Yakima River), and naturally spawning stocks that have developed from straying hatchery stocks (Mid-Columbia Brights and Bonneville Pool Tules). Mid-Columbia River spring chinook may be targeted by ceremonial and subsistence and recreational fisheries in the Yakima drainage.

Since 1938, the largest runs of salmon and steelhead (hatchery and natural combined) to the mouth of the Columbia River occurred during the 1980s, averaging approximately 1.8 million fish per year (Figure 3.5-2). However, over this period the stock composition has changed from primarily wild to primarily hatchery origin as habitat loss and hatchery mitigation have replaced wild stocks both above and below Bonneville Dam. Runs during 1991 to 1997 were the lowest since 1938, averaging 1.1 million fish per year. Tables 3.5-1 and 3.5-2 summarize the status of naturally produced stocks and the relative success of meeting harvest management and biological goals for key species groups in the Columbia River basin. Chinook comprise 50 percent of the total salmonid runs in the Columbia River, and the fall run represents more than 60 percent of chinook runs. During the late 1800s, the native summer chinook run was believed to be the largest component of the Columbia River basin's runs (Chapman 1996). Natural runs of summer chinook, sockeye, chum, and spring chinook have shown the greatest decline since the 1940s. While fall chinook, coho, and winter and summer steelhead runs have not shown a continuous decline in the last 60 years, they are heavily sustained by hatchery production and were somewhat below average in the 1990s.[14,15,16]

The natural spawning escapement of upriver bright fall chinook has been relatively large since 1985, averaging 61,000 spawners per year. The majority of these fish return to the Hanford Reach, the last free-flowing section of the Columbia River, between the Snake River confluence and Priest Rapids Dam near Kennewick, Washington. Some return to the Yakima River basin. Fall chinook returning to the Snake River are a distinct ESU and listed as threatened. Counts of upper river basin chinook at McNary Dam have consistently exceeded the current goal of 45,000 fish since 1982 (Council 1999b). As a result of hatchery strays spawning in the wild, the natural spawning component of the Mid-Columbia River Brights run has increased from no fish in the early 1980s to approximately 13,000 spawners per year (Council 1999b). The natural spawning population of the Bonneville Pool Hatchery run (tules) has averaged approximately 1,500 fish per year since 1970. Approximately 14,000 to 50,000 hatchery fall chinook (tules) spawn in tributaries of the lower Columbia River below Bonneville Dam but the trend has been downward since 1989 (Council 1999b).

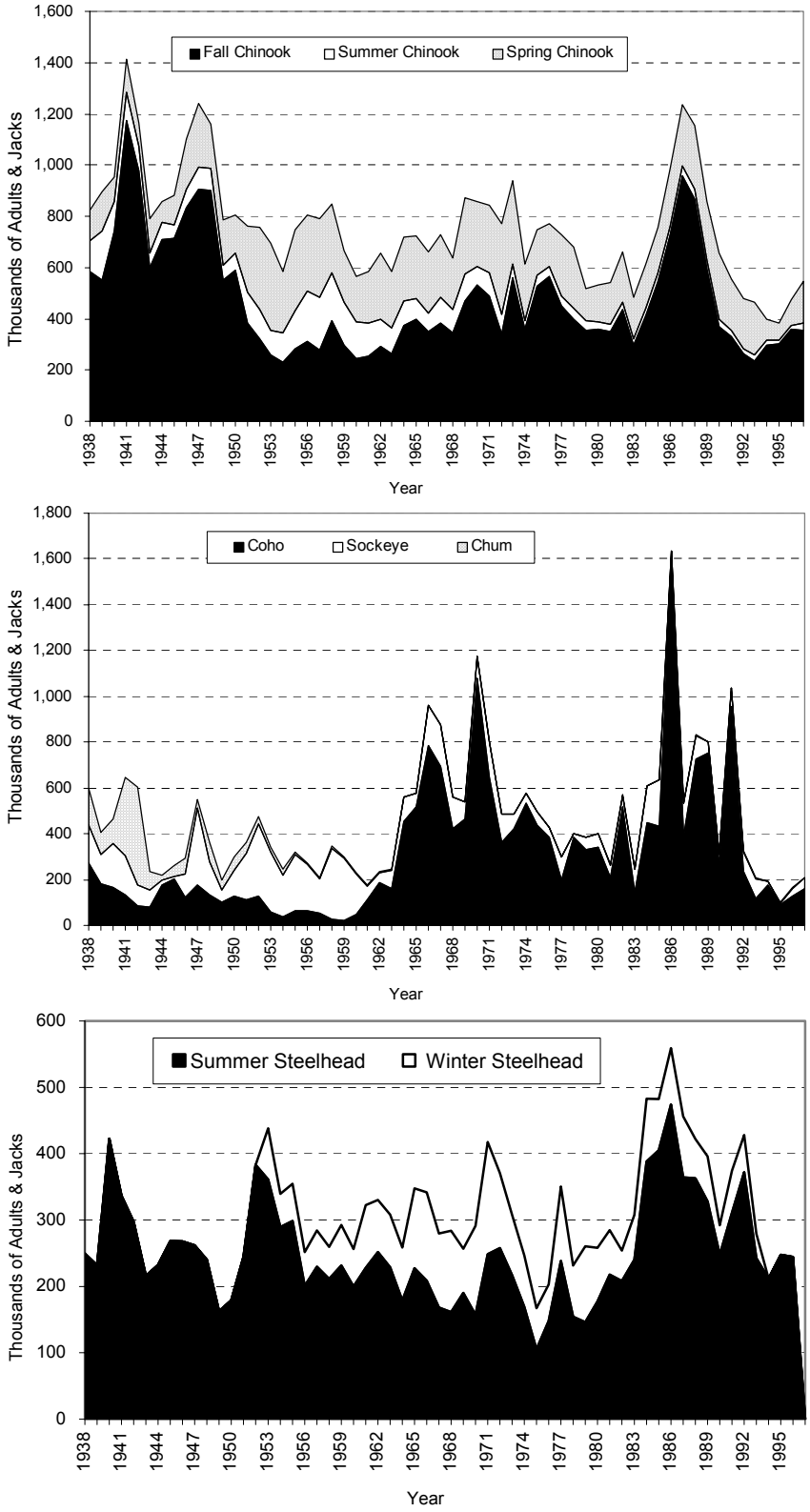
Historically, coho salmon were common throughout the Columbia River basin (Mullan 1984, Johnson 1991) but naturally spawned populations are presently found only in tributaries of the lower Columbia River[17]. Since the 1960s, hatchery releases have accounted for 90 percent or more of the coho run that has supported major fisheries in the

[14] Fishery managers maintain long-term counts of fish passage at dams and harvests, but these statistics typically include hatchery fish (ODFW and WDFW 1998); therefore, abundance indices are based on redd counts, which are subject to considerable measurement error and may also reflect straying of hatchery fish to the spawning grounds. Managers often assume that redd counts represent approximately 40 percent of the total salmon abundance within the surveyed area.

[15] Minimum run size estimates of salmon and steelhead based on counts at dams and monitoring of fishing harvests are available for years since 1938. Harvest statistics are available before this period.

[16] Indices of natural spring and summer chinook abundance of unlisted runs are largely based on redd counts in the middle Columbia River basin tributaries. Spring chinook redd counts in the Deschutes, John Day, and Yakima river basins have been low since at least 1970 but a downward trend is not readily apparent (Table 3.4-2). Escapement of hatchery and wild spring chinook has been consistently below the goals at the McNary Dam counting station and the uppermost Snake River dam station since 1970 (Council 1999b). Aerial counts of summer chinook redds in the upper Columbia River tributaries since 1960 (range: 500 to 3,000 redds) have not displayed a downward trend, but escapement of hatchery and wild summer chinook at McNary Dam has been considerably below the goal since at least 1970.

[17] The Yakama Nation is attempting to restore coho runs to the Yakima River basin.




Source: ODFW and WDFW 1998

**Figure 3.5-2.** Minimum numbers of mature and precocious salmon and steelhead entering the Columbia River, 1938 to 1997.

**Table 3.5-1.** Status of non-listed, naturally produced salmon stocks in the Columbia River basin.

| Species ESU | Escapement Trend | Escapement Goal Met? |
|---|---|---|
| Mid-Columbia River Spring Chinook (Deschutes, John Day, Yakima stocks) | low and variable | hatchery/wild mixed goal not met |
| Deschutes River Summer/Fall Chinook | summer run is down, fall is up | no goal |
| Upper Columbia Summer/Fall Chinook | | |
| Summer Run | low and variable | historical hatchery/wild mixed goal not met since 1970; PSC interim goal met most years |
| Fall Run | stable | all years since 1982 typically well above goal |
| Lower Columbia River/Southwest WA Coho | very low and downward | no goal |
| Okanogan and Wenatchee Sockeye ESUs | downward | 30% of years 1988-97 |

Source: Myers et al. (1998) ODFW and WDFW (1998), Council (1999b).

**Table 3.5-2.** Achievement rates of harvest management goals and biological goals for key species groups in the Columbia River basin.

| Species | Management and Harvest Goals | Period | Goal Achieved? |
|---|---|---|---|
| Upriver Spring Chinook | Escapement at Bonneville Dam (115,000) | 1977-97 | 15% of years |
| | Wild escapement at Lower Granite Dam | 1979-97 | Never |
| | Non-Tribal harvest rate (2%) | 1996-97 | All years |
| | Tribal harvest rate (depends on run size) | 1996-97 | Not in 1997 |
| Lower River Fall Chinook | Escapement (5,700 Lewis River bright) | 1976-97 | All years |
| | PSC escapement (5,791 Lewis River bright) | 1976-97 | All years |
| | PST: 2 consecutive years below lower escapement goal | 1988-95 | All years |
| Willamette Spring Chinook | Escapement (variable: > 30,000) | 1988-97 | 50% of years |
| | Harvest Rate (depends on run size) | | |
| Summer Chinook | Escapement at Bonneville Dam (80,000-90,000) | 1969-97 | Never |
| | PSC interim escapement at Bonneville (17,857 UCR stock) | 1979-95 | 50% of years |
| | PSC interim escapement at Rock Island (12,143 UCR stock) | 1979-95 | 65% of years |
| | PST Trigger: 2 cons. yrs below lower goal (9,658 at R.I.) | 1988-95 | All years |
| | Non-Tribal harvest rate (< 1%) | 1996-97 | All years |
| | Tribal harvest rate (5%) | 1996-97 | All years |
| Upriver Fall Chinook | Escapement (43,500) at McNary Dam (URB) | 1990-97 | All years |
| | 30% Harvest rate reduction over 1988-93 period | 1996-97 | All years |
| | Harvest rate (29.7%)-Snake River Wild | 1997 | No, small deviation |
| Wild Summer Steelhead | Escapement at Bonneville (62,200)-A run | 1988-97 | 10% of years |
| | Escapement at Bonneville (13,300)-B run | 1988-97 | 10% of years |
| | Escapement at Lower Granite (20,000)-A run | 1988-97 | Never |
| | Escapement at Lower Granite (10,000)-B run | 1988-97 | Never |
| | Harvest rate (Zone 6: < 15%)-A Run | 1988-97 | 9 of 10 years |
| | Harvest rate (Zone 6: < 32%)-B Run | 1988-97 | All years |
| Winter Steelhead | Wild fish escapement | 1997 | No |
| Sockeye | Escapement at Bonneville Dam (75,000) | 1988-97 | 30% of years |
| | Escapement at Priest Rapids Dam (65,000) | 1988-97 | 40% of years |
| | Harvest rate (depends on run sizes) | 1996-97 | All years |
| Coho | Escapement to hatcheries | 1988-97 | All years |
| Chum | No goals (not targeted) | | |

lower Columbia River and elsewhere. Harvest rates were based on achieving necessary hatchery escapement. Indices of spawning escapement in lower river tributaries show a major decline in naturally spawning coho salmon since the 1960s. A field study of coho spawning in Washington streams of the Columbia River during 1998 reported that 98 percent of the observed coho had originated from hatcheries rather than from naturally spawning parents (Ruggerone 1999). Exceptionally high harvest rates on hatchery fish and habitat degradation have led to the possibility that this ESU is extinct (Johnson 1991hilcote 1998, Ruggerone 1999). Oregon has listed coho in the Columbia River as threatened under its new endangered species policy (M. Chilcote, ODFW, personal communication).

Most sockeye presently return to tributaries of the upper Columbia River having nursery lakes; however, development activities have blocked approximately 96 percent of sockeye nursery lake habitat in the Columbia River basin (Mullan 1986). Snake River sockeye salmon are endangered. Estimated run size (mostly wild fish) to the Columbia River and spawning escapement at Priest Rapids Dam have been somewhat low during the 1990s compared to 1970 through 1988. Sockeye met the escapement goal 30 percent of the years from 1988 to 1997.

Some harvest rate objectives have been reduced since 1997 as a result of biological opinions by NMFS. Note that the Pacific Salmon Commission interim escapement goal for Columbia River upriver summer chinook has not been adopted by the Chinook Technical Committee and is not currently used in the Pacific Salmon Treaty process (ODFW/WDFW 1999; TAC 1998, JCRMS 1998, J. Clark, ADF&G, personal communication).

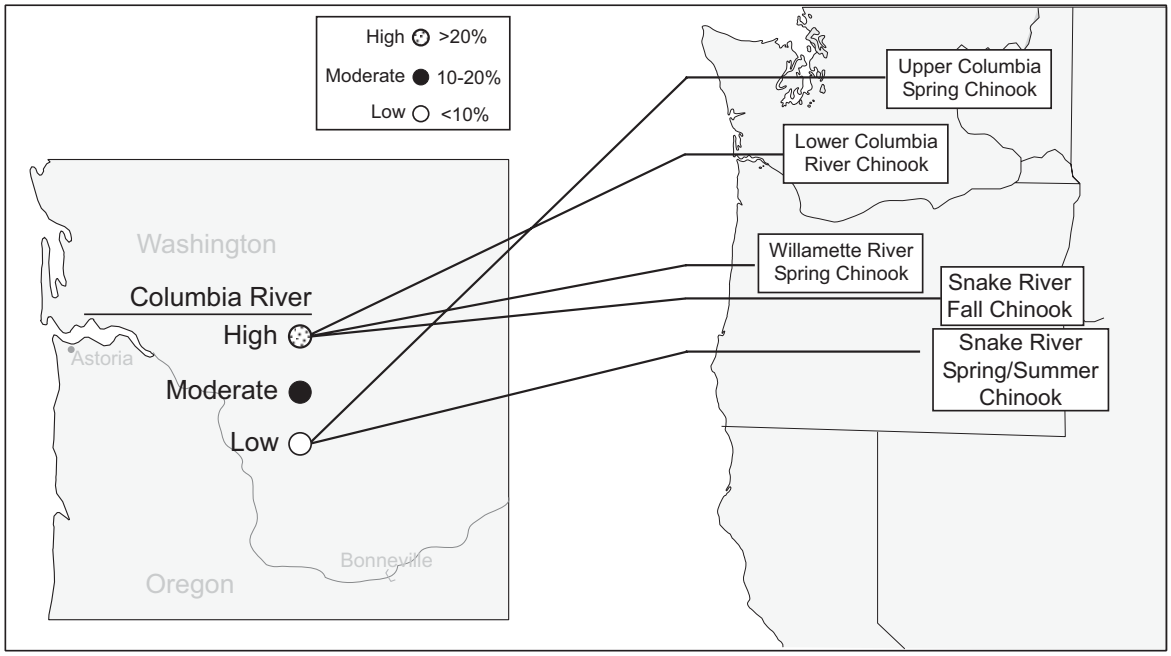
#### 3.5.2.2 Listed Salmonids

Listed salmonids originating from the Columbia River basin include Snake River spring/summer chinook, Snake River fall chinook, Upper Columbia River spring chinook, Lower Columbia River chinook, upper Willamette River chinook, Columbia River chum, Snake River sockeye, all five steelhead ESUs, and Columbia River bull trout. All species are listed as threatened except Snake River sockeye; Upper Columbia River spring chinook; Upper Columbia River steelhead, which are designated as endangered; and cuttroat, which are proposed for listing. Critical habitat within the watershed has been designated or proposed for all listed salmon and steelhead (57 FR 57051).

Historic harvest rates for listed chinook ESUs in the Columbia River fisheries are shown in Figure 3.5-3 and are described below. Historical and recent run sizes, population trends, and factors for decline for each of these ESUs is summarized in Table 3.5-3. Unless otherwise noted, information on chinook ESUs is summarized from Matthews and Waples (1991) (Snake River spring/summer chinook), Busby et al. (1996) (steelhead), and Myers et al. (1998) (all other chinook).

**Snake River Sockeye ESU**

Snake River sockeye are not harvested in ocean fisheries. There have been no commercial fisheries directed at sockeye since 1988. Some sockeye are caught incidentally during summer season fisheries in the Columbia both above and below Bonneville Dam. Since listing, the total harvest rate on listed sockeye has averaged less than 5%.




Notes: Percent refers to approximate harvest rate in these fisheries that were observed in years before listing (typically 1980s and early 1990s).
Low, medium, and high references are for comparison purposes in this FPEIS. Depending on various factors, a harvest rate which is high for one stock may be moderate for another stock.

**Figure 3.5-3.** Historic harvest rates for listed chinook ESUs in Columbia River fisheries.

**Columbia River Chum ESU**

Columbia River chum are not taken in ocean or above Bonneville Dam. Harvest is limited to late season fall fisheries in the lower Columbia River and has been 5% or less in recent years.

**Lower Columbia River Chinook ESU**

Hatchery chinook from the lower Columbia River comprise a majority of ocean chinook harvest in the Council management area fisheries north of Cape Falcon and comprise a minor component south of Cape Falcon. This ESU is also taken in the lower Columbia River and its tributaries and, to lesser extent, by British Columbia and Southeast Alaska fisheries.[18] Harvest rates on fall-run stocks are moderately high, averaging 65 percent exploitation for the 1982 to 1989 brood years (PSC 1994). The average ocean exploitation rate for this period was 46 percent and the freshwater harvest rate on the fall run averaged 20 percent, ranging from 30 percent in 1991 to 2.4 percent in 1994. Harvest rates are somewhat lower for spring-run stocks. Estimates for the Lewis River spring run average 24 percent ocean and 50 percent total exploitation rates for 1982-1989 brood years (PSC 1994). The inriver (mainstem Columbia) harvest rate for the fall component of this ESU was 38 percent from 1988 to 1993 and 12 percent from 1994 to 1997.

[18] Southeast Alaska fisheries account for approximately 9.8 percent of fishery effects on the Lewis River wild fall chinook run, an indicator stock for this ESU.

**Table 3.5-3.** Status and non-harvest related factors for decline of Columbia River chinook salmon and steelhead ESUs.

| ESU | Recent Natural Run Size | % Wild in ESU | Historic Run Size | Population Trend | Fisheries Effects |
|---|---|---|---|---|---|
| **Lower Columbia Chinook (T 3/99)**<br>Includes numerous short and medium-length streams draining the coast ranges and west slopes of the Cascades, with a single large river (the Willamette.)<br>The ESU includes spring-run chinook salmon in the Cowlitz, Lewis, Kalama, Sandy, and Clackamas Rivers. Approximately 68% of the natural spawners may be first-generation hatchery strays.<br>A major component of this ESU (Lewis River bright fall stock) has been considered relatively healthy.<br>All basins are affected by habitat degradation including blockages, forest practices, urbanization in the Portland and Vancouver areas, and agriculture in floodplains and low-gradient tributaries.<br>Influence of hatchery fish on natural populations is pervasive. | 11,000 spring<br>29,000 fall | 20 | Unknown | Short-term negative. Long-term mixed. | Moderate to high north of and within Columbia River. |
| **Upper Willamette Spring Run Chinook (T 3/99)**<br>Includes native spring-runs above Willamette Falls.<br>Available habitat has been reduced by construction of dams in the Santiam, McKenzie, and Middle Fork Willamette River basins, which have probably adversely affected remaining production via thermal effects. Agricultural development and urbanization are main causes of serious habitat degradation throughout the basin. | 1,000-4,000 | 10 | | Wild runs not replacing themselves. | Moderate in ocean fisheries, high in Columbia, but reduced to low in recent years. |
| **Upper Columbia Spring Run Chinook (T 3/99)**<br>Includes stream-type chinook salmon spawning above Rock Island Dam in the Wenatchee, Entiat, and Methow rivers.<br>Chief Joseph and Grand Coulee dams blocked access to a substantial portion of historical habitat. There are local habitat problems related to irrigation diversions and hydroelectric development, as well as degraded riparian and in-stream habitat from urbanization and livestock grazing. Mainstem Columbia River hydroelectric development has resulted in a major disruption of migration corridors and affected flow regimes and estuarine habitat.<br>Significant impacts from hatcheries. | ≤ 5,000<br>(1990-1994) | 30 | | Long-term decline. Short-term increasing trend (1998-2001). | Low in Columbia. Very rare in ocean. |
| **Snake River Spring / Summer Run (T 4/92)**<br>Spring and/or summer chinook spawned throughout the Snake River basin An estimated 44% of all Columbia River spring and summer chinook salmon entered the Salmon River, the largest Snake River tributary. The total production of the Snake River was probably in excess of 1.5 million spring and summer chinook salmon for some years during the late 1800s.<br>Prior to hydroelectric development, many small tributary habitats were lost or severely damaged by construction and operation of irrigation dams and diversions; inundation of spawning areas by impoundment's; and siltation and pollution from sewage, farming, logging, and mining. More recently, the construction of hydroelectric and water storage dams without adequate provisions for adult and juvenile passage in the upper Snake River has precluded the use of all spawning areas upstream from Hells Canyon Dam. | 125,000 from 1950-1960<br>recently < 50,000 | 30 | ≤ 1.5 million in 1800s | Long term low, except record high returns in 2000 and 2001. | Low in Columbia. Rare in ocean. |
| **Snake River Fall Chinook (T 4/92)**<br>Columbia River chinook salmon populations were at one time acknowledged as the largest in the world and the Snake River was the most important salmon-producing drainage in the Columbia system.<br>The Hells Canyon Dam complex blocked almost all historical spawning habitat in the Snake River. Remaining habitat has been reduced by inundation from lower Snake River reservoirs. Spawning and rearing habitats in the mid-Columbia River region are affected largely by agriculture including water withdrawals, grazing, and riparian vegetation management. | 1997-2001 average run size at Lower Granite > 1,000 | ??? | 72,000 in 1940s | Long term decline, but increasing trend since 1994. | Moderate to high in Columbia River and ocean. |

**Table 3.5-3.** Status and non-harvest related factors for decline of Columbia River chinook salmon ESUs (continued).

| ESU | Recent Natural Run Size | % Wild in ESU | Historic Run Size | Population Trend | Fisheries Effects |
|---|---|---|---|---|---|
| **Lower Columbia River Steelhead (T 3/98)**<br>Composed of winter and summer steelhead, occupying tributaries Columbia tributaries between the Cowlitz and Wind Rivers in Washington and the Willamette and Hood Rivers in Oregon.<br>Significant habitat blockages resulted from dams on the Sandy River, and minor blockages (such as impassable culverts) are likely throughout the region. Clearcut logging has been extensive throughout most watersheds in this area, and urbanization is a substantial concern in the Portland and Vancouver areas.<br>Hatchery fish spawn naturally throughout the region. | < 40,000 winter<br>< 20,000 summer | < 20 | | Majority recently declining but some increasing. | Very rare in ocean, low in river. |
| **Upper Willamette Steelhead (T 3/99)**<br>Occupies the Willamette River and its tributaries upstream from Willamette Falls.<br>Substantial habitat blockages resulted from Detroit, Big Cliff and Green Peter Dams on the Santiam River, and flood control dams on the mainstem Willamette. Clearcut logging has been common throughout most watersheds in this area. In the Willamette Valley, temperatures and stream flows reach critical levels Bank erosion is severe in several areas of the basin; and splash dams, debris removal and stream channelization have caused long-term damage to salmonid habitats.<br>Substantial numbers of winter-and summer-run hatchery steelhead spawn in the wild. | < 5,000 late winter<br>< 2,000 early winter<br>< 10,000 summer | 14-54 | Not available | Declining since 1971 with large fluctuations in abundance. | Very rare in ocean, low in river. |
| **Middle Columbia Steelhead (T 3/99)**<br>Occupies the Columbia River basin above the Wind River (WA) and the Hood River (OR), including the Yakima River<br>The only substantial habitat blockage in this ESU is at Pelton Dam on the Deschutes River. Water withdrawals have reduced summer flows in the tributaries of the Deschutes River. Riparian vegetation is heavily affected by overgrazing and other agricultural practices, timber harvest, road building, and channelization. | 37,000 | < 30 | ≥ 300,000 pre-1960s | | Very rare in ocean, low in river. |
| **Upper Columbia Steelhead (E 8/97)**<br>Occupies Columbia tributaries upstream from the Yakima River primarily draining the northern Cascades Mountains of Washington.<br>Hatchery fish spawn naturally throughout the region.<br>There is concern about the apparent high harvest rates on steelhead smolts in rainbow trout fisheries and the degradation of freshwater habitats within the region, especially the effects of grazing, irrigation diversions, and hydroelectric dams. | < 1,000 in Wenatchee River<br>< 500 in the Methow and Okanogan rivers | < 30 | Unknown | Long-term declining. Short-term increase since 1997 with highest natural run since 1986 in 2001. | Very rare in ocean, low to moderate in river. |
| **Snake River Basin Steelhead (T 8/97)**<br>Occupies the Snake River basin of southeast Washington, northeast Oregon, and Idaho. Snake River steelhead are often classified into two groups, A- and B-run, based on migration timing, ocean age, and adult size.<br>Recent droughts have likely hurt production.<br>The major migration barriers are the Hells Canyon Dam complex on the mainstem Snake River and Dworshak Dam on the North Fork Clearwater River. Riparian vegetation affected by overgrazing and other agricultural practices, timber harvest, road building and channelization. Hatchery fish spawn naturally throughout the region. | < 17,600 | < 15 of total run | Unknown | Long-term decline, increasing trend since 1996. | Very rare in ocean, low to moderate in river. |

Notes: [1/] The strongest upward trends are either non-native stocks (Lower Willamette River and Clackamas River summer steelhead) or stocks that are recovering from major habitat disruption and are still at low abundance (mainstem and North Fork Toutle River). The data series for most stocks is quite short, so the preponderance of downward trends may reflect the general coastwide decline in steelhead in recent years.

**Upper Willamette Spring Chinook ESU**

NMFS estimates that the combined harvest rate on this ESU from 1980 to the early 1990s was 65 percent, with the majority of effects occurring in fisheries in the Columbia and Willamette rivers. Because Willamette spring-run chinook are a north-migrating species, they are rarely taken in Council management area fisheries, and Pacific Coast ocean exploitation rates are thought to be less than 1 percent (Council 1999a). This ESU is believed to be taken with some frequency in Southeast Alaska (where approximately 9 percent of fishing effects on Willamette Hatchery stocks occur [PSC 1999]) and British Columbia.

The Columbia River harvest rate for this ESU was 52 percent from 1988 to 1993 and 43 percent from 1994 to 1997. Upper Willamette spring chinook are taken primarily by sport fisheries and, previously, by lower river commercial fisheries targeting the Willamette River hatchery run. Harvest rates have been considerably lower in tributaries supporting natural spring chinook during the past few years (R. Beamesderfer, ODFW, personal communication).

**Upper Columbia River Spring Run Chinook ESU**

NMFS has estimated total harvest rate on this ESU at 9 percent in the 1980s and early 1990s. Recently, harvest rates have been declining. Southeast Alaska and Pacific Coast ocean fishery effects are rare (i.e., not measurable).

**Snake River Spring/Summer Run Chinook ESU**

Effects on this ESU from Pacific Coast fisheries are rare (i.e., assumed to be close to zero) (Council 1999a) and this is also assumed to be true for Southeast Alaska fisheries. The main fishery effects on this run are from Tribal ceremonial and subsistence fisheries in the Columbia River, but harvest rates are extremely low. NMFS estimates the total harvest rate to be 6 percent (NMFS 2000b).

**Snake River Fall Run Chinook ESU**

Fisheries from northern California to British Columbia and Southeast Alaska[19] affect this ESU, although effects are relatively infrequent south of central Oregon. Canadian troll fisheries also affect this ESU. Recent historic harvest rates (1988 to 1996) have been estimated at 53 percent for all areas (NMFS 1997a). Council management area exploitation rates on this stock, which ranged from approximately 15 to 20 percent before listing, have been approximately 10 to 11 percent in recent years (NMFS 1997a). The harvest rate in the Columbia River for this ESU was approximately 29 percent from 1988 to 1993 and declined to 21 percent from 1994 to 1997.

**Lower Columbia River Steelhead ESU**

This ESU is taken almost entirely by sport fishers in the Columbia River and its tributaries. Before implementation of mark-selective fisheries in the 1980s, harvest rates may have been as high as 60 percent.

[19] From 1988-1996 Southeast Alaska fisheries accounted for approximately 13 percent of the harvest-related effects on this ESU.

**Upper Willamette River Steelhead ESU**

This ESU is taken primarily by sport fisheries in the Willamette system. Overall harvest rates on natural-origin fish are less than 2 percent.

**Middle Columbia River Steelhead ESU**

This is ESU is taken by Tribal gillnet fishermen and sport fishermen. NMFS has estimated harvest rates from the1980s to early 1990s to be 4 percent.

**Upper Columbia River Steelhead ESU**

Naturally produced upriver steelhead (three ESUs combined, A&B runs) are primarily harvested in Zone 6 Tribal fisheries and by anglers in Columbia River tributaries. Sport fishermen are required to release unmarked, wild steelhead. An estimated 11,300 naturally produced steelhead were harvested per year in Zone 6 from 1988 to 1993 (compared to 3,100 per year during 1994 to 1997) and harvest rates declined from 19 to 10 percent.

**Snake River Basin Steelhead ESU**

This ESU is likely taken primarily by middle Columbia River Tribal gillnet fisheries and by sport fisheries in the Snake River and its tributaries.

**Bull Trout**

The Columbia River distinct population of bull trout was listed as threatened in June 1998. The proposed rule for this and other bull trout populations included a special 4(d) rule allowing sport fishing to continue in accordance with state, Tribal, national park, and fish and wildlife conservation laws and regulations. This ruling indicates sport fishing, as presently conducted in the Columbia River basin, does not have a measurable effect on bull trout. Most bull trout are located in headwaters of tributaries upstream of Zones 1 through 6 (Rieman et al. 1997); therefore, commercial and ceremonial and subsistence fisheries in Zones 1 through 6 would not likely have an effect on bull trout.

**Cutthroat Trout**

Cutthroat trout in the southwestern Washington/Columbia River ESU have been proposed as threatened (64 FR 16397; April 5, 1999) and a final determination on their status is expected in September 2000. Management of this ESU is now under the jurisdiction of the USFWS (65 FR 21376; April 21, 2000.) In the Columbia River basin, this ESU extends east to The Dalles Dam and includes the Willamette River up to Willamette Falls. Cutthroat trout are not targeted in commercial fisheries and bycatch in commercial gillnet fisheries is minimal because of the large mesh size of gillnets relative to the size of cutthroat trout. Because sport harvest of naturally produced coastal cutthroat trout is restricted in many areas, direct mortality due to fishing pressure is thought to be relatively low, at least in recent years (Johnson et al. 1999). Recent fishing regulations in Washington and Oregon require the release of all coastal cutthroat trout, except adipose-clipped hatchery fish, in most streams in the lower Columbia River basin. Bag and size limits on recreational harvest of cutthroat trout are in effect in all lower Columbia River basin streams not subject to regulations.

#### 3.5.2.3 Non-Salmonid Fish Species

In the Columbia River, non-salmonids are rarely taken incidentally in salmon or steelhead fisheries. Those taken include sturgeon, shad, walleye, and northern pike minnow (squawfish). Walleye and northern pike minnow are known predators of juvenile salmon and are believed to take large numbers of downstream migrating salmon and steelhead, particularly near dams.

#### 3.5.2.4 Listed and Unlisted Mammalian Species

Population information and occurrence of listed and unlisted mammals in the Columbia River are summarized in Tables 3.3-1 and 3.4-3. Fisheries interactions with these species are rare and are believed to have no significant effect on mammalian species. More detailed information on these species is given in Appendix B.

#### 3.5.2.5 Listed and Unlisted Avian Species

Population information and the occurrence of listed and unlisted avian species in the Columbia River are summarized in Tables 3.3-1 and 3.4-3. Additional information is provided in Appendix B. Aquatic birds that are present in the action area include the marbled murrelet, common murre, puffins, grebes, cormorants, and surf scoters. The marbled murrelet is the only listed bird likely to be encountered in lower Columbia River fisheries (J. Grettenberger, USFWS, personal communication).

#### 3.5.2.6 Lower Trophic Level Species (Forage Fishes)

In the Columbia River, juvenile salmonids may feed on a variety of aquatic insects, primarily in larval and pupal stages, and some terrestrial insects. Predation on other fish species by juveniles is uncommon. Smelt are available to salmonids, although the frequency with which adult salmon returning to the river may actually feed on these is uncertain.

### 3.5.3 Human Environment

#### 3.5.3.1 Historical Fisheries

In the past, salmon and steelhead extensively used the Columbia River and its tributaries. Chinook salmon migrated nearly 1,200 miles up the Columbia River to Lake Windemere, Canada, and 600 miles up the Snake River to Shoshone Falls near Twin Falls, Idaho. Adult salmon and steelhead runs, before development in the Columbia River basin, are estimated to have ranged from 10 to 16 million fish.

Columbia River salmon were central to American Indian life for thousands of years before the arrival of Europeans. The fishery at Celilo Falls, near The Dalles, Oregon, was a renowned gathering place and center of trade on the West Coast for centuries before the construction of The Dalles Dam in 1957. By 1861 commercial fishing had become important to European settlers. In 1866 salmon canning began and the commercial fishery grew very rapidly. The early commercial fishery used gillnets, seines hauled from beaches, traps, and fish wheels. The number of canneries increased to a peak of 39 in 1886. The amounts and types of gear employed also increased. There were 2,856 gillnet boats in 1915,

104 haul seines in 1928, 506 traps in 1926, and 76 fish wheels in 1899; dip net licenses peaked at 477 in 1935. Commercial fisheries initially harvested spring and summer chinook, switching to other runs when these declined. Landings exceeded 40 million pounds annually in the late 1800s, between 1915 and 1919, and in 1925. Commercial landings were usually canned.

The Columbia River mainstem fishery is currently divided into a non-Tribal commercial fishery between the downstream end of the Bonneville Dam to the Pacific Ocean (Zones 1 through 5) and a Tribal fishing area between the McNary Dam and the area just upstream of the Bonneville Dam (Zone 6). The commercial fishery above Bonneville Dam was open to fishing by both American Indians and non-American Indians until 1956 (Figure 3.5-1). Sport fishing is permitted (according to state restrictions) throughout the Columbia River and its tributaries.

#### 3.5.3.2 Commercial Salmon Fishery

Since 1938, salmon and steelhead commercial landings have ranged from 2 million fish (31.6 million pounds) in 1941 to 68,000 fish (0.9 million pounds) in 1995. During the 1990s, total salmon and steelhead landings averaged 196,000 fish or 2.1 million pounds.[20] The 1997 non-Tribal mainstem and select-area fisheries produced the second lowest salmon harvest on record: 29,900 fish (331,300 pounds) or 29 percent of the total Columbia River commercial salmon harvest. The select-area fisheries accounted for 68 percent of the commercial salmon landings below Bonneville Dam in 1997. With severe constraints placed on the mainstem fishery because of depressed and ESA-listed stocks, select-area fisheries have become an important management tool.

**Commercial Harvest and Effort Trends**

The number of licenses issued in the non-Tribal commercial fishery since 1938 has ranged from a low of 597 in 1969 to a high of 1,524 in 1979, declining to 689 in 1997. A vessel permit moratorium went into effect in 1980. In the mid-1980s, in an effort to reduce harvest capacity, 288 licenses were purchased from fishermen by the State of Washington and permanently retired. In 1995 and 1996, 135 additional Washington licenses were similarly retired.

The number of seasons and fishing days for the commercial mainstem fishery below Bonneville Dam has declined dramatically over the last 50 years. Before 1943, seasons were closed only in March and April and from August 25 to September 10. In the past two decades, spring fisheries have been shortened or eliminated, summer fisheries eliminated, and severe time and area constraints placed on fall fisheries. All commercial fishing for spring and summer chinook has been closed during the Baseline years considered.

As discussed in Chapter 4, the annual average harvest in two recent periods, 1988-1993 and 1994-1997, is used to estimate effects of the different alternatives given varying abundance levels of salmon. From 1988 to 1993 the average non-Tribal commercial troll harvest of

[20] Since 1995 an increasing proportion of treaty Tribal commercial landings have been sold to the general public and non-licensed fish dealers because of low prices paid by dealers. The tribes monitor and estimate the commercial sale to the public and report it together with ticketed landings during the commercial season.

chinook salmon on the West Coast was 2.2 million pounds valued at $3.6 million. For the same period of time, 1.5 million pounds of coho valued at $1.9 million were harvested. Between 1994 and 1997 the average non-Tribal troll chinook harvest of approximately 134,000 was valued at approximately $100,000. Coho salmon harvest and value also decreased to annual averages of 267,000 pounds valued at approximately $197,000 from 1994 to 1997 (Figure 3.5-4).

#### 3.5.3.3 Processors

While the Astoria and Ilwaco port areas were historically important salmon processing centers, declining harvests in the Columbia River have led to major declines in these industries. Groundfish, shrimp, and crab fisheries that take place off the coast support most processing or buying operations in the lower Columbia River. There are two salmon buyers/processors in Cathlamet, Washington, and one each in Longview and Vancouver, Washington (Council 1999b). There are 35 salmon buyers/processors listed in Astoria but fewer than 5 have substantial operations (Council 1999b; NRC 2000). Salmon purchasing agents may range up and down the river, but processing operations are limited to Astoria.

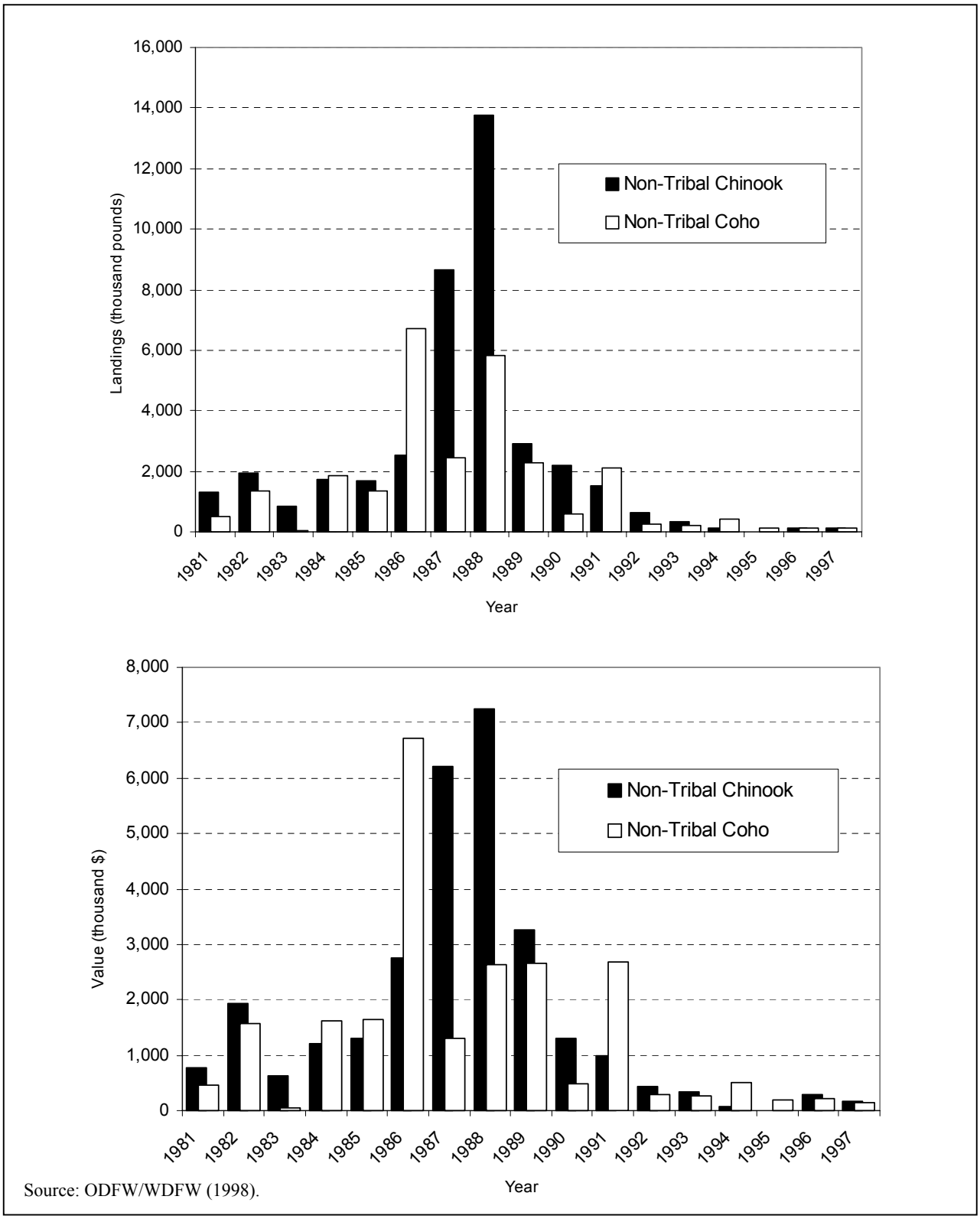
#### 3.5.3.4 Consumers of Salmon

As described in Section 3.3.3.5, worldwide and U.S. consumption of fresh and frozen salmon has steadily increased over the last 18 years. The main market for Columbia River salmon is domestic, with some chinook going to the smoking market in Europe.

#### 3.5.3.5 Commercial Fishery Economic Value

As described in Section 3.3.3.5, the economic value of the commercial salmon fishery can be measured by the value the fishery generates for producers and consumers. For non-Tribal commercial fishers the gross (ex-vessel) value of the salmon harvest was $754,100 in 1997, a continuation of ex-vessel values under $1 million since 1993 (Table 3.5-4). Ex-vessel values for non-Tribal commercial chinook and coho salmon landings began declining rapidly in the early 1990s. The non-Tribal gillnet fishery averaged approximately $7.3 million in ex-vessel value from 1984 to 1993. The treaty gillnet fishery generated an average of $2.1 million in ex-vessel value from 1982 to 1991. Ex-vessel values for chinook and coho landings in the American Indian fishery also declined dramatically in the early 1990s (Figure 3.5-5). In 1997 Tribal fishermen sold approximately $477,000 of coho and chinook to dealers and another $571,000 to the general public.

The Columbia River contributes fish to commercial fisheries from northern California to Southeast Alaska. Commercial ex-vessel values per chinook for ocean troll and river gillnet fisheries combined have been approximately $30. Net income (revenues less the costs of operations) received by non-Tribal gillnet salmon fishers was an estimated $302,000 in 1997. This estimate is based on a net income coefficient of 0.40 derived from IMPLAN for Pacific Coast commercial fisheries. The commercial salmon fishery also generates economic value for seafood processors. Reliable information is not available on the income generated by processing salmon harvested from the Columbia River; however, salmon processing in California is estimated to generate 39 percent of the net income generated for




Source: ODFW/WDFW (1998).

**Figure 3.5-4.** Columbia River non-Tribal chinook and coho salmon landings and ex-vessel value, 1981 to 1997.

**Table 3.5-4.** Annual average Washington sport salmon and steelhead harvest and effort by stream system, county where fisheries are located, origin of angler, affected communities, 1988 to 1993.

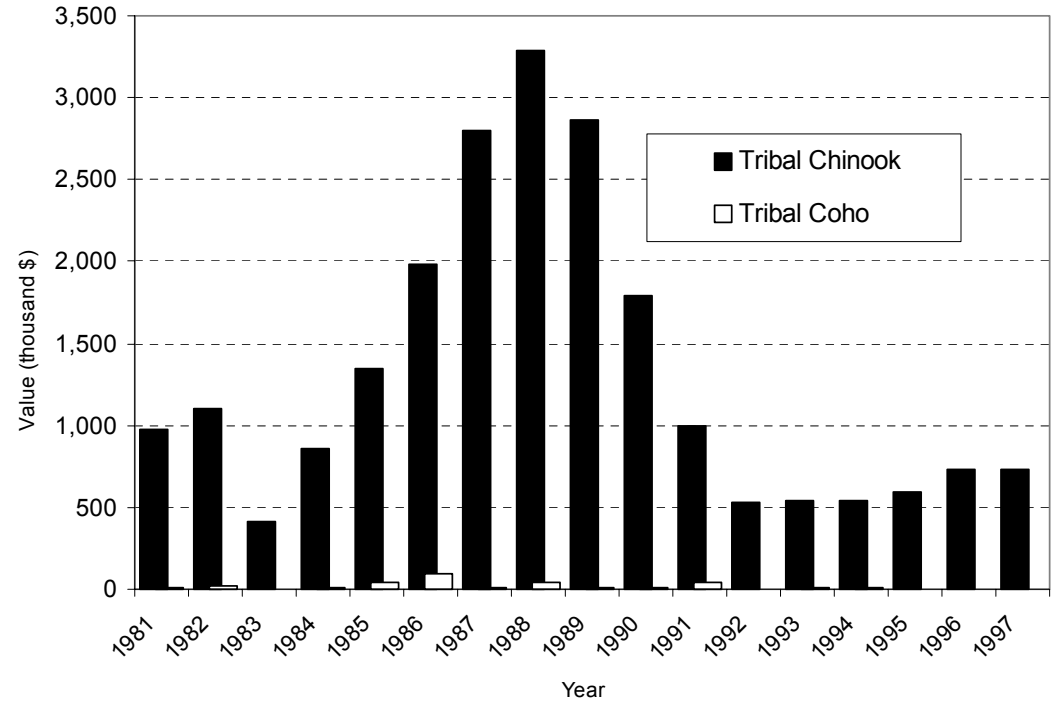
| Zone | Stream | Catch | Effort | Counties | Communities |
|---|---|---|---|---|---|
| 1-5 | Lower Columbia River | 116,072 (53%) | 299,863 (26%) | Pacific, Wahkiakum | Ilwaco, Cathlamet, Chinook |
| 1-5 | Cowlitz River | 27,318 (13%) | 227,649 (20%) | Cowlitz, Lewis | Toledo, Longview, Kelso, Vancouver, Castle Rock |
| 1-5 | Lewis River | 22,256 (10%) | 185,469 (16%) | Cowlitz | Longview, Kelso, Woodland, Vancouver |
| 6 | Upper Columbia River | 14,437 (7%) | 120,310 (11%) | Klickitat, Benton, Franklin | Richland, Pasco, Kennwick, Other |
| 1-5 | Kalama River | 8,708 (4%) | 72,564 (6%) | Cowlitz | Kalama, Longview, Kelso |
| 1-5 | Washougal River | 5,852 (3%) | 48,769 (4%) | Clark | Washougal, Camas, Vancouver |
| 6 | White Salmon River | 5,559 (3%) | 46,328 (4%) | Skamania | White Salmon, Stevenson |
| 1-5 | Elochoman River | 3,867 (2%) | 32,225 (3%) | Wahkiakum | Cathlamet |
| 6 | Wind River | 3,549 (2%) | 29,578 (3%) | Skamania | White Salmon, Stevenson |
| 6 | Klickitat River | 2,503 (1%) | 20,861 (2%) | Klickitat | White Salmon, Klickitat, Lyle |
| 6 | Little White Salmon River | 1,904 (1%) | 15,869 (1%) | Wahkiakum | Leavenworth |
| 6 | Mid Columbia River | 940 (0%) | 7,833 (1%) | Skamania, Klickitat | Stevenson, Carson, White Salmon |
| >6 | Icicle River | 922 (0%) | 7,682 (1%) | Chelan | Leavenworth |
| >6 | Wenatchee River | 893 (0%) | 7,440 (1%) | Chelan | Wenatchee, Cashmere, Leavenworth |
| 1--5 | Tilton River | 802 (0%) | 6,682 (1%) | Lewis | Morton |
| 6 | Ringold | 718 (0%) | 5,986 (1%) | Benton | Richland, Pasco, Kennwick, Other |
| 1-5 | Grays River | 577 (0%) | 4,806 (0%) | Wahkiakum | Cathlamet |
| >6 | Yakima River | 115 (0%) | 954 (0%) | Yakima | Yakima |

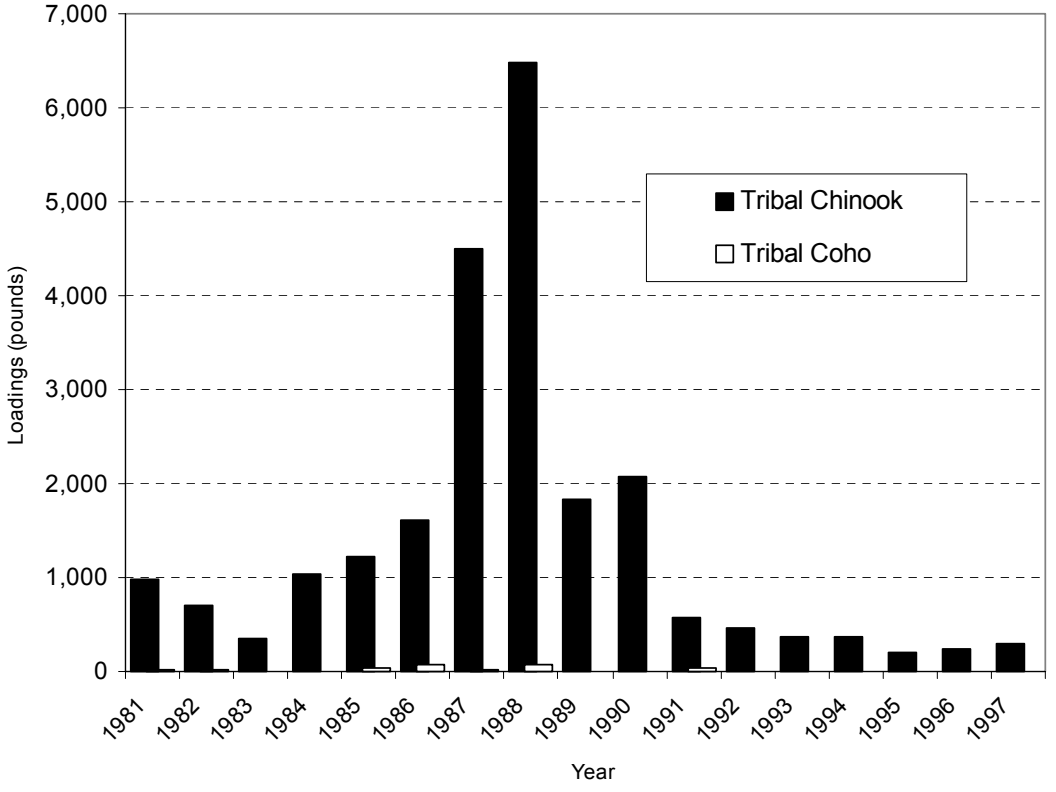
commercial salmon fishers (USFWS 1995). Based on this relationship, net income to processors associated with the 1997 salmon harvest in the Columbia River was approximately $118,000.

### 3.5.3.6 Sport Salmon Fishery

There are two general recreational fishery management areas below Bonneville Dam—the lower Columbia area extending from Bonneville Dam downstream to the Astoria-Megler Bridge and the Buoy 10 area extending from below the Astoria-Megler Bridge to Buoy 10, which marks the ocean/inriver boundary. Approximately 80 percent of the recreational harvest and effort in the Columbia River system occurs in the lower river and tributaries. Accounting for approximately 20 percent of harvest and effort, the recreational fisheries above Bonneville Dam are geographically widespread and socially important.

Much of the recreational harvest in both the lower and upper Columbia River occurs in tributaries. The Cowlitz, Lewis, Kalama, and Elochoman rivers in Washington and the Willamette, Sandy, and Santiam rivers in Oregon account for approximately 45 percent of the lower Columbia River basin salmon and steelhead harvest. Above Bonneville Dam, the Klickitat, White Salmon, and Little White Salmon tributaries in Washington the Deschutes in Oregon, and other tributaries account for approximately 60 percent of the salmon and steelhead harvest. Tables 3.5-4 and 3.5-5 show annual average sport harvest and effort for 1988 through 1993 in the Columbia River and tributaries for Washington and Oregon sport salmon and steelhead fisheries. The Snake River and its main tributaries, the Clearwater and Salmon, account for 35 percent of the upriver steelhead harvest from the Columbia River system.




Source: ODFW and WDFW (1998).

**Figure 3.5-5.** Columbia River Tribal chinook and coho salmon landings and ex-vessel value, 1981 to 1997.

**Table 3.5-5.** Annual average Oregon sport salmon and steelhead harvest and effort by stream system, county where fisheries are located, origin of angler, and affected communities, 1988 to 1993.

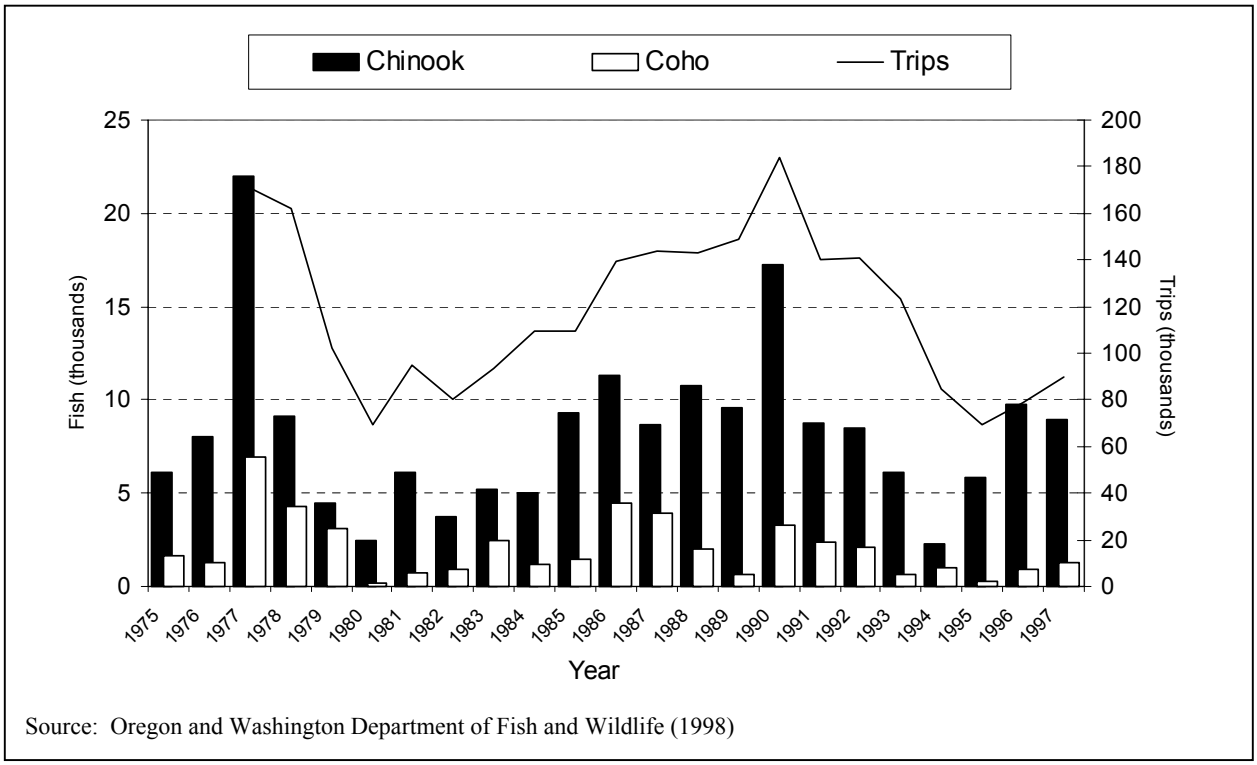
| Zone | Stream | % Catch | Effort | Counties | % effort from within state | % effort from within area | Communities |
|---|---|---|---|---|---|---|---|
| 1-5 | Lower Mainstem | 6 | 238,748 (24%) | Clatsop | 93 | 12 | Astoria, Warrenton, Hammond |
| 1-5 | Willamette | 3 | 274,142 (28%) | Multnomah, Clackamas, Washington | 99 | 43 | Portland |
| 1-5 | Clackamas | 2 | 113,576 (11%) | Multnomah, Clackamas, Washington | 99 | 43 | Portland, Gresham |
| 1-5 | Sandy | 2 | 98,448 (10%) | Multnomah, Clackamas, Washington | 99 | 43 | Portland, Gresham |
| 1-5 | Santiam | 1 | 53,217 (5%) | Marion, Linn | 99 | 43 | Salem, Albany, Stayton |
| 6 | Deschutes | 1 | 52,981 (5%) | Wasco, Sherman | 99 | 22 | Maupin, Madras |
| 6 | Upper Mainstem | 1 | 48,166 (5%) | Hood River, Wasco, Sherman | 96 | 31 | Cascade Locks, Hood River, The Dalles, Umatilla |
| 6 | John Day | 0 | 30,033 (3%) | Sherman, Gilliam | 89 | 39 | Biggs |
| 1-5 | McKenzie | 0 | 22,137 (2%) | Lane | 99 | 43 | Springfield |
| 6 | Hood | 0 | 23,818 (2%) | Hood River | 99 | 22 | Hood River |
| 6 | Grand Ronde | 0 | 23,382 (2%) | Wallowa | 89 | 39 | La Grande, Elgin, Troy |
| 1-5 | Lower Mainstem Tributaries | 0 | 16,894 (2%) | Clatsop, Columbia | 96 | 31 | Astoria, Warrenton, Hammond, St. Helens |

**Sport Harvest and Effort Trends**

Before 1975, lower Columbia River recreational fisheries were primarily for salmon and steelhead. Closures for spring chinook and summer steelhead severely reduced salmon angling opportunities from 1975 to 1983. Improved upriver summer steelhead, upriver fall chinook, and lower river spring chinook runs since 1984 have allowed for greater angling opportunities. In 1997 a total of 90,000 angler trips were made on the lower Columbia River; 17,300 salmon and steelhead were caught (Figure 3.5-6).

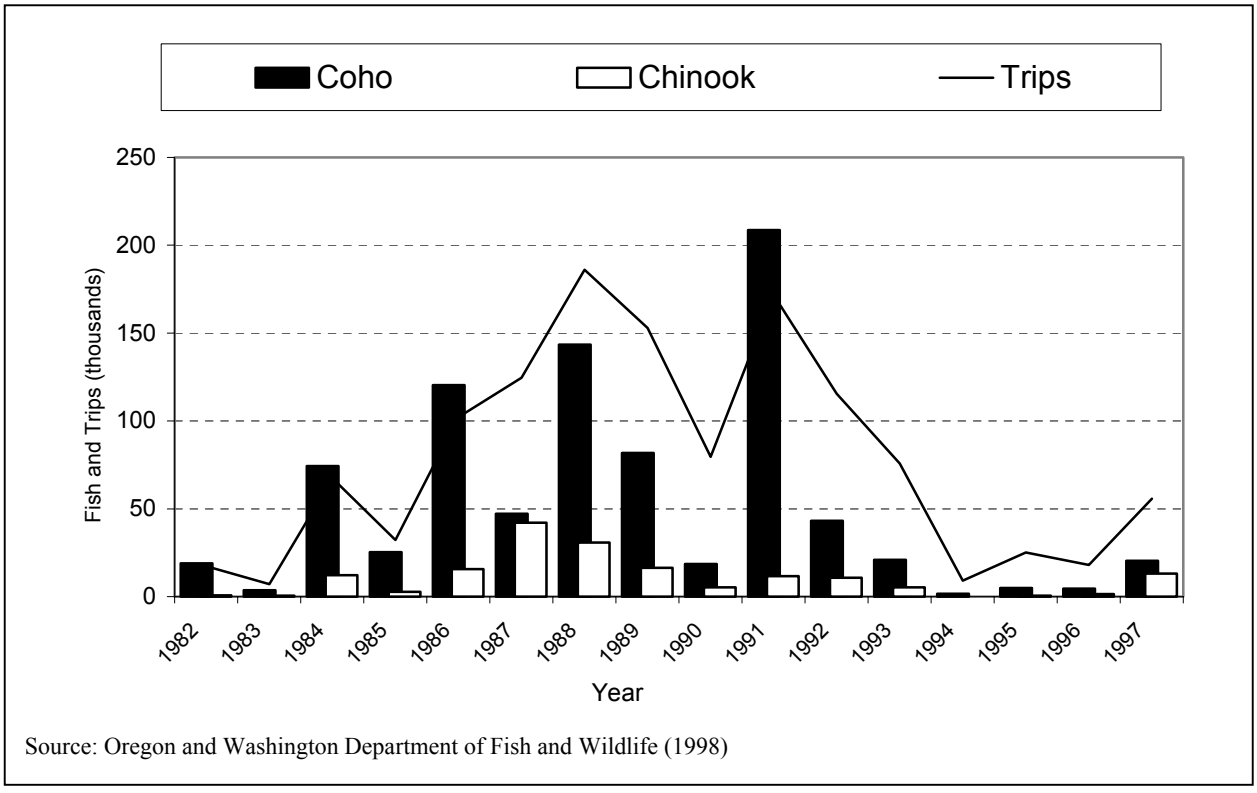
From 1988 to 1997, recreational effort and harvest have decreased significantly in the Columbia River estuary (Buoy 10) and lower and upper mainstem tributaries (Figure 3.5-7). From 1988 to 1993 the estuary harvest averaged approximately 99,000 salmon, of which about 14 percent were chinook and the remaining were coho. From 1994 to 1997 the annual average harvest decreased to approximately 12,000 salmon, of which about one-third were chinook and two-thirds coho. Angler trips averaged approximately 128,000 per year from 1988 to 1993 compared to 27,000 per year from 1994 to 1997.

Harvest from 1988 to 1993 averaged approximately 132,000 salmon and steelhead in the lower Columbia River mainstem and tributaries; spring and fall chinook, summer and winter steelhead, and coho accounted for 45, 44, and 11 percent of the harvest, respectively. Lower mainstem and tributary harvest from 1994 to 1997 declined to approximately 68,000 salmon and steelhead per year; spring and fall chinook, summer and winter steelhead, and coho accounted for 35, 57, and 5 percent of the harvest, respectively. Angler trips decreased from approximately 1 million trips per year from 1988 to 1993 to 400,000 trips per year from 1994 to 1997.




Source: Oregon and Washington Department of Fish and Wildlife (1998)

**Figure 3.5-6.** Lower Columbia River salmon trips and harvest, 1975 to 1997.




Source: Oregon and Washington Department of Fish and Wildlife (1998)

**Figure 3.5-7.** Estuary (Buoy 10) salmon trips and harvest, 1982 to 1997.

The average annual sport harvest of salmon and steelhead in the upper Columbia River mainstem and tributaries was approximately 113,000 from 1988 to 1993, with (an estimated) 695,000 angler trips. Steelhead and chinook comprised 82 and 18 percent of the harvest, respectively. For the 1994-1997 period, approximately 362,000 angler trips per year occurred, which resulted in an average harvest of 60,000 steelhead and 15,000 chinook.

**Recreational Fishing-Related Businesses**

Businesses affected by sport fishing for salmon and steelhead on the Columbia River include charterboat operations, marinas, lodging, food and beverage establishments, transportation services, marine stores (boats and accessories), bait and tackle stores, general sporting goods stores, service stations, and miscellaneous retail trade stores. In 1996 revenues at sport fishing-related businesses generated by sport fishing for salmon and steelhead on the Columbia River were an estimated $35.0 million based on 730,800 angler days. Approximately 51, 45, and 4 percent of this angler spending is estimated to have occurred in Washington, Oregon, and Idaho counties, respectively.

### 3.5.3.7 Recreational Fishery Economic Value

As described in Section 3.2.3.7, the economic value of the salmon and steelhead sport fishery can be measured by the value it generates for consumers and producers. Even though sport-caught salmon do not have a market price, the value to anglers can be measured by their WTP for fishing trips. WTP includes the amount of money anglers actually pay (angler spending) plus the additional amount that they would be willing to pay (net economic value) to continue sport fishing for salmon and steelhead.

The net economic value (benefits) to anglers associated with sport fishing for salmon and steelhead on the Columbia River has been estimated at $24.8 million in 1996. Anglers in Washington realized approximately $12.6 million in benefits, and Oregon and Idaho anglers realized approximately $11.3 million and $992,000, respectively. It should be noted that the sport fishing effort in 1996 was one of the lowest in recent years.

The net economic value of the sport fishery to producers (e.g., charterboat operators, marinas, and other sport fishing-related businesses) is measured by the net income (or profit) generated by sales to recreational anglers. Based on an average net income coefficient of 11.6 percent derived from IMPLAN for sport fishing-related businesses, the net income generated by sport fishing for salmon and steelhead on the Columbia River in 1996 has been estimated at $4.1 million. Sport fishing-related businesses in Washington received the largest share of this net income, which has been estimated at $2.1 million.

### 3.5.3.8 Treaty American Indian Fishery

A major treaty Tribal dip net fishery was located at Celilo Falls that was permanently inundated in 1957 by The Dalles Dam, thus ending the Tribal fishery that had occurred for millennia. Commercial treaty Tribal landings at Celilo Falls ranged from 0.8 to 3.5 million pounds annually from 1938 to 1956. In 1968, as a result of a Supreme Court ruling, the states were required to allow treaty fishing at usual and accustomed places in the mainstem Columbia River above Bonneville Dam. In recent years, the Tribes have increased their reliance on direct sales to the public. These sales have grown, making up an important

component of the ex-vessel value. In 1969 general regulations including fishing areas, river mouth closures, dam sanctuaries, and gear regulations were adopted.

### 3.5.3.9 Fishing Communities

This section describes the affected environment to assess changes in economic and social conditions in communities in the Columbia River basin. The affected human environment is described for the most recent time frame for which data are consistently available, but reference is made to conditions in earlier years or changes over longer periods of time to the extent they illustrate trends or tendencies important to the analysis.

**Regional Overview**

The lower Columbia River mainstem is bounded on the Washington side by Pacific, Wahkiakum, Cowlitz, Clark, and Skamania counties and on the Oregon side by Clatsop, Columbia, and Multnomah counties (Figure 3.5-8). Contained in this area are the major metropolitan area of Portland-Vancouver and the smaller cities of Astoria, Oregon, and Longview and Kelso, Washington. Major interstate highways cross the Columbia River at Portland and parallel its south bank from Astoria east to Idaho. The transportation corridor on the north side of the river is a secondary route. Commercial fishermen travel throughout the lower river depending on open areas or the best fishing opportunity; however, approximately 75 percent of the fleet is concentrated in the ports of Ilwaco and Cathlamet, Washington; and Astoria-Warrenton, Oregon. The remainder of the fleet is spread among the much smaller ports of St. Helens-Rainier, Clatskanie, and Dodson, Oregon; and the Washington communities of Skamokawa, Kalama, Longview, and Vancouver (King, S., ODFW, personal communication).

Skamania, Klickitat, Benton, Franklin, Walla Walla, Grant, Yakima, and Chelan counties bound the Columbia River above Bonneville Dam and below Grand Coulee Dam on the Washington side. On the Oregon side it is bounded by Hood River, Wasco, Sherman, Gilliam, Morrow, and Umatilla counties.

Tribal commercial and ceremonial and subsistence fisheries occur throughout the upper Columbia River but are concentrated in the area from Bonneville Dam to The Dalles Dam within Hood River County, Oregon, and Skamania and Klickitat counties, Washington. Tribal communities within the affected environment (as discussed in the following section) are spread over a larger area.

Because a major portion of recreational fisheries takes place in Columbia River tributaries, the communities impacted by fishing tourism are widespread. Important Washington tributary sport fisheries include those in the Cowlitz, Toutle, Kalama, Washougal, Klickitat, and Wind rivers located within Cowlitz, Clark, Lewis, Skamania, and Klickitat counties. In Oregon, the Willamette, Clackamas, and Sandy rivers located within Multnomah, Clackamas, and Linn counties have important recreational fisheries. In Umatilla County, the Deschutes River, bounded by Sherman, Morrow, and Gilliam counties and the John Day

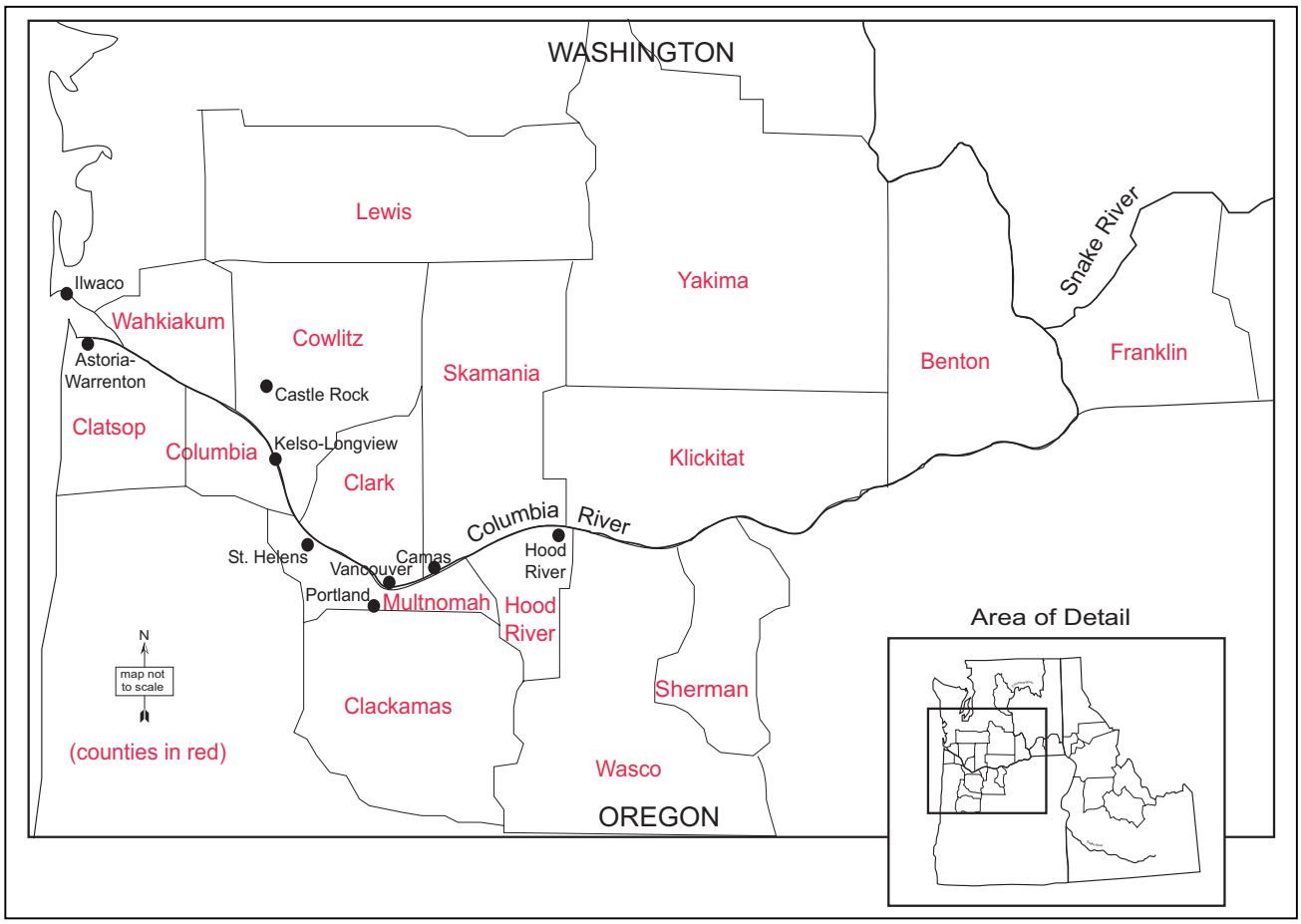



**Figure 3.5-8.** Lower Columbia River counties and communities.

River, has the most important upper Columbia River tributary sport fisheries in Oregon, but other fisheries exist in tributaries ranging as far south as the McKenzie (tributary to the Willamette) in southern Oregon and the Grande Ronde in eastern Oregon (Table 3.5-5). Approximately 35 percent of the Columbia River system's upriver sport steelhead harvest is taken in Idaho in the Snake, Clearwater, and Salmon rivers. Idaho, Nez Perce, Valley, Lemhi, Custer, and Clearwater counties border the Snake River in Idaho with its important sport steelhead and Tribal fisheries.

**Population Characteristics**

Total population in the counties that comprise the affected environment was approximately 2.2 million in 1998 (Table 3.5-6); Washington counties comprised 43 percent, Oregon counties 53 percent, and Idaho counties 4 percent of the total. More than 60 percent of the population is centered in four counties surrounding the greater metropolitan area of Portland, Oregon, and Vancouver, Washington, including Multnomah and Clackamas counties, Oregon, (642,000 and 324,000 residents, respectively) and Clark and Cowlitz counties, Washington (328,000 and 93,000 residents, respectively). The other major population centers are the cities of Yakima in Yakima County, Washington (population 218,000) and the Tri-Cities area (Pasco, Kennewick, Richland) in Benton County, Washington (population 133,000). Population increased 15.7 percent within the affected environment

**Table 3.5-6.** Key population and income statistics for counties in the Columbia River basin region.

| State | County | 1990 | 1998 | % Change | Per Capita Income | % Below Poverty |
|---|---|---|---|---|---|---|
| WASHINGTON | Wahkiakum | 3,327 | 3,900 | 17.2 | $17,765.00 | 9.0 |
| | Cowlitz | 82,119 | 93,100 | 13.4 | $19,700.00 | 12.6 |
| | Clark | 238,053 | 328,000 | 37.8 | $22,579.00 | 9.3 |
| | Lewis | 59,358 | 68,600 | 15.6 | $17,895.00 | 14.1 |
| | Skamania | 8,289 | 9,900 | 19.4 | $17,370.00 | 10.7 |
| | Klickitat | 16,616 | 19,100 | 14.9 | $16,975.00 | 16.0 |
| | B/F/Y/C[1/] | 391,106 | 455,000 | 16.3 | $19,494.00 | 15.4 |
| Subtotal/Average | | 798,868 | 977,600 | 22.4 | $18,825.00 | 12.4 |
| OREGON | Clatsop | 33,424 | 34,700 | 3.8 | $19,472.00 | 13.4 |
| | Columbia | 37,859 | 42,300 | 11.7 | $19,004.00 | 8.7 |
| | Multnomah | 586,000 | 641,900 | 9.5 | $52,955.00 | 13.5 |
| | Clackamas | 280,906 | 323,600 | 15.2 | $25,343.00 | 6.8 |
| | Linn | 91,742 | 102,200 | 11.4 | $18,413.00 | 13.8 |
| | HR/W/S[2/] | 40,650 | 44,000 | 8.2 | $17,219.00 | 13.4 |
| Subtotal/Average | | 1,070,581 | 1,188,700 | 11.0 | $20,901.00 | 11.6 |
| IDAHO | Idaho | 13,768 | 15,056 | 9.4 | $14,556.00 | 15.7 |
| | Nez Perce | 33,754 | 36,852 | 9.2 | $20,376.00 | 11.4 |
| | Valley | 6,109 | 8,005 | 31.0 | $20,192.00 | 12.6 |
| | L/C/CW[3/] | 19,537 | 21,447 | 9.8 | $16,311.00 | 13.5 |
| Subtotal/Average | | 73,168 | 81,370 | 11.2 | $17,859.00 | 13.3 |
| **TOTALS** | | **1,942,617** | **2,247,670** | **15.7** | **$19,331.00** | **12.3** |

Notes: [1/] Benton/Franklin/Yakima/Chelan
[2/] Hood River/Wasco/Sherman
[3/] Lemhi/Custer/Clearwater
Source: U.S. Census Bureau 1999.

between 1990 and 1998. Washington State counties experienced a 22.4 percent population increase and counties in Oregon and Idaho grew 11.0 and 11.2 percent, respectively. The most rapid growth in absolute and percentage terms was in Clark County, which added nearly 90,000 residents for a 37.8 percent change between 1990 and 1998.

**Employment, Income, and Poverty Levels**

For the counties in the Columbia River basin, the service sector accounts for approximately 30 percent of jobs, followed by wholesale and retail trade (23 percent); government (13 percent); manufacturing (12 percent); insurance, financial, and real estate services (7 percent); mining and construction (6 percent each); transportation, communication, and utilities (5 percent); and agriculture, forestry, and fisheries (2 percent) (Table 3.5-7). In general, apportionment of employment among sectors is similar for the three states. Notable exceptions are Wahkiakum County (population 1,100), where the agriculture, forestry, and fisheries sector accounts for 21 percent of employment and government jobs account for 22 percent, and Skamania and Klickitat counties, where government jobs comprised 21 percent and 32 percent of the labor force, respectively.

**Table 3.5-7.** Distribution of employment by major industry sector in 1996 for Washington, Oregon, and Idaho counties in the Columbia River basin.

| State | County | Agriculture, Forestry and Fisheries | Mining and Construction | Manufacturing | Transportation, Communications, and other Utilities | Wholesale and Retail Trade | Finance, Insurance, Real Estate | Services | Government | Total Labor Force | Unemployment Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WASHINGTON | | | | | | | | | | | |
| | Wahkiakum | 21.1% | 0.9% | 0.0% | 5.3% | 21.4% | 5.6% | 23.4% | 22.2% | 1,133 | 6.8% |
| | Cowlitz | 1.9% | 7.6% | 22.3% | 4.6% | 22.3% | 4.9% | 23.8% | 12.5% | 45,972 | 8.6% |
| | Clark | 1.1% | 8.8% | 15.2% | 4.7% | 22.1% | 8.0% | 26.8% | 13.3% | 139,179 | 4.4% |
| | Lewis | 3.2% | 6.6% | 15.7% | 5.1% | 26.4% | 4.8% | 22.3% | 16.0% | 32,023 | 9.9% |
| | Skamania | 1.9% | 4.8% | 12.3% | 3.5% | 12.5% | 1.2% | 31.5% | 32.3% | 2,559 | 11.4% |
| | Klickitat | 6.8% | 6.5% | 18.7% | 7.7% | 12.6% | 5.3% | 20.7% | 21.6% | 7,820 | 12.3% |
| | B/F/Y/C[1/] | 4.6% | 5.6% | 8.9% | 4.6% | 24.9% | 5.3% | 30.8% | 15.3% | 224,429 | 11.5% |
| Subtotal | | 3.2% | 6.9% | 12.9% | 4.7% | 23.6% | 6.0% | 28.1% | 14.7% | 453,115 | 9.3% |
| OREGON | | | | | | | | | | | |
| | Clatsop | 5.3% | 5.3% | 15.2% | 3.1% | 25.7% | 4.1% | 27.1% | 14.2% | 20,867 | 6.3% |
| | Columbia | 3.1% | 6.8% | 17.1% | 7.2% | 22.0% | 5.2% | 23.6% | 15.1% | 13,603 | 6.1% |
| | Multonomah | 0.6% | 5.2% | 10.3% | 6.9% | 21.6% | 8.7% | 34.3% | 12.3% | 522,435 | 5.1% |
| | Clackamas | 2.5% | 7.7% | 11.4% | 3.8% | 28.4% | 7.7% | 29.0% | 9.7% | 157,120 | 3.9% |
| | Linn | 2.5% | 6.4% | 24.4% | 4.6% | 21.6% | 4.3% | 23.8% | 12.4% | 51,296 | 7.0% |
| | HR/W/S[2/] | 2.2% | 4.6% | 13.2% | 2.0% | 29.3% | 2.1% | 29.5% | 17.0% | 21,570 | 9.6% |
| Subtotal | | 1.3% | 5.8% | 11.8% | 5.9% | 23.3% | 7.8% | 32.1% | 12.0% | 786,891 | 6.3% |
| IDAHO | | | | | | | | | | | |
| | Idaho | 2.7% | 8.8% | 15.2% | 5.3% | 19.4% | 5.0% | 20.8% | 22.8% | 6,427 | 11.1% |
| | Nez Perce | 0.2% | 5.7% | 16.2% | 5.5% | 24.3% | 7.1% | 28.2% | 12.7% | 24,427 | 3.5% |
| | Valley | 3.4% | 13.1% | 5.0% | 3.7% | 23.5% | 7.4% | 24.0% | 19.9% | 5,454 | 9.3% |
| | L/C/CW[3/] | 3.7% | 11.8% | 12.0% | 4.4% | 23.0% | 4.0% | 13.3% | 27.8% | 9,581 | 8.7% |
| Subtotal | | 1.7% | 8.3% | 13.9% | 5.0% | 23.3% | 6.2% | 23.6% | 18.1% | 45,889 | 8.2% |
| **TOTALS** | | **2.0%** | **6.3%** | **12.2%** | **5.5%** | **23.4%** | **7.1%** | **30.3%** | **13.2%** | **1,285,895** | **8.0%** |

Notes: [1/] Benton/Franklin/Yakima/Chelan
[2/] Hood River/Wasco/Sherman
[3/] Lemhi/Custer/Clearwater

"0" values are reported for confidentiality for some counties.

Category totals may not account for subcomponents of each labor sector category where figures were omitted for confidentiality.

Source: Oregon State University Government Information Sharing Program, Regional Economic Information System, 1969-1997, U.S. Bureau of Census (1999), Oregon Economic & Community Development Department, Idaho Department of Labor

The average unemployment rate for Columbia River basin counties was 8 percent in 1996, somewhat higher than the average unemployment rate for the states of Washington (9.3 percent) or Oregon (6.3 percent). The lowest unemployment rates in Washington were 4.4 percent in Clark County and 6.8 percent in Wahkiakum County; rates in other counties ranged from 8.7 to 12.3 percent (Table 3.5-7). In Oregon, Clackamas and Multnomah counties (comprising much of the greater Portland metropolitan area) had a 3.9 and a 5.1 percent unemployment rate, respectively, and other Columbia River basin counties' unemployment rates ranged from 6.1 to 9.6 percent. Unemployment rates in Idaho State counties ranged from a low of 3.5 percent in Nez Perce County to 11.1 percent in Idaho County.

Annual per capita income for Columbia River basin counties in Washington averaged $18,825 and ranged from $16,975 (Klickitat County) to $22,579 (Clark County). Per capita income for Columbia River basin counties in Oregon averaged $20,091 and ranged from $17,219 (Hood River/Wasco/Sherman) to $25,955 (Multnomah County). Annual per capita income for Columbia River counties in Idaho State averaged $17,859 and ranged from $14,556 (Idaho County) to $20,376 (Nez Perce County). Population, income, and poverty statistics are shown in Table 3.5-6.

Poverty rates in Washington averaged 12.4 percent and ranged from 9.0 percent (Wahkiakum County) to 16.0 percent (Klickitat County) for Washington counties in the Columbia River basin. In Oregon poverty rates ranged from 6.8 percent (Clackamas County) to 13.8 percent (Linn County) and averaged 11.6 percent. Poverty rates in Idaho State averaged 13.3 percent and ranged from 11.4 percent (Nez Perce County) and 15.7 percent (Idaho County) for counties in the Columbia River basin.

### 3.5.3.10 Columbia River Treaty Indian Tribes

Tribes located along the Columbia and Snake rivers that have a vested interest in activities affecting salmon harvesting include Yakama Nation, Confederated Tribes of Warm Springs, Confederated Tribes of Umatilla, Shoshone-Bannock Tribe, and Nez Perce Tribe (Figure 3.5-9). Other Tribes located in the Columbia River basin may be indirectly affected.

#### Yakama Nation

***Current Characteristics***

The Yakama Indian Reservation, comprised of 1.4 million acres (1,573 square miles), is located in Klickitat and Yakima counties in south-central Washington. The reservation has an agricultural area located in the bottom of the Yakima Valley, range or grazing lands in the foothills, and forested areas in the western and southern parts of the reservation. There are 8,870 Tribal members and Tribal headquarters are located near Toppenish, Washington. The Yakama Nation operates a number of businesses and a museum, and provides approximately 600 full-time jobs and another 200 part-time forestry jobs in the summer.

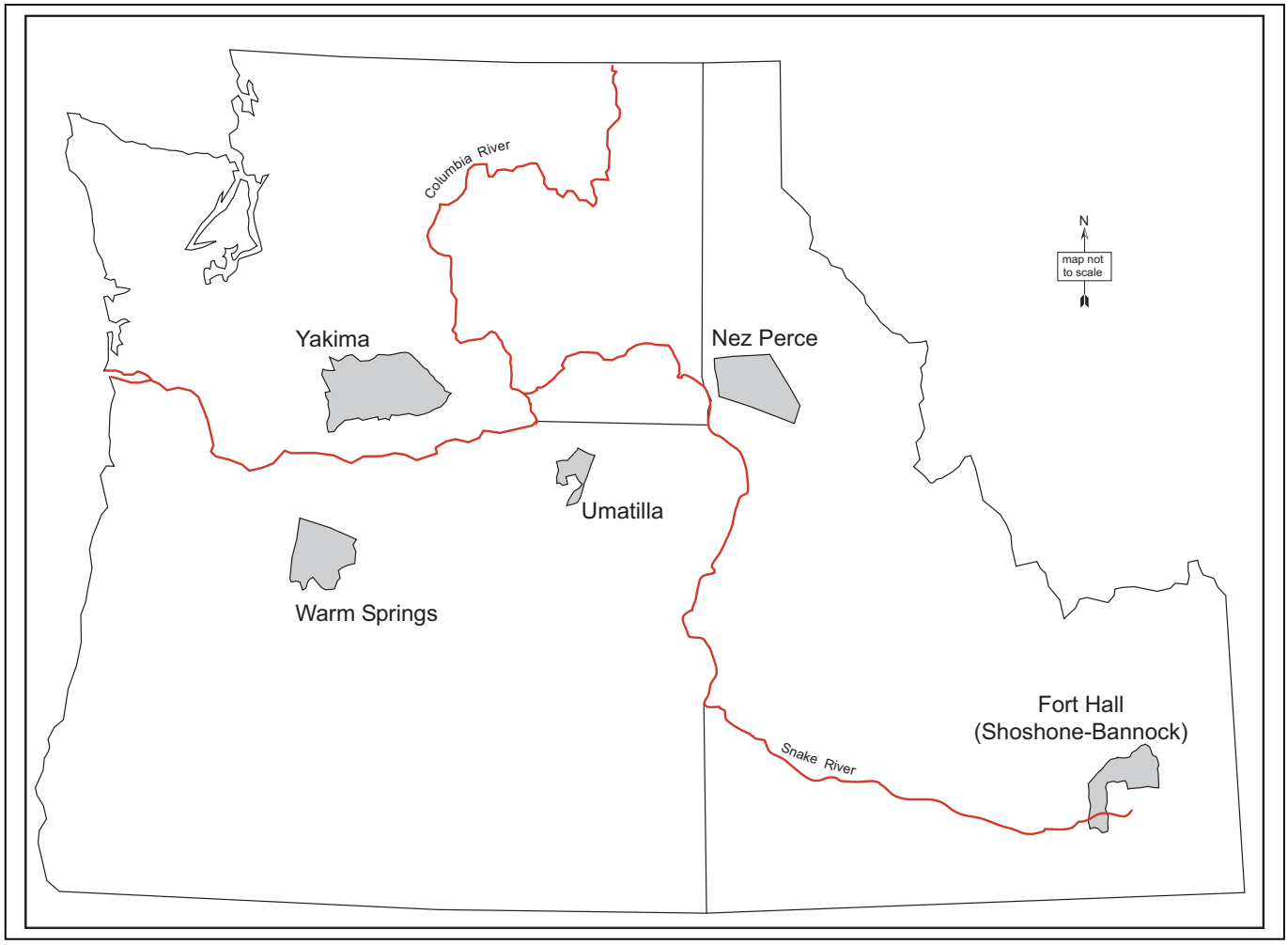



**Figure 3.5-9.** Location of Tribal nations that are party to the Columbia River Fisheries Management Plan.

***History***

The Yakama Nation, which is comprised of 14 bands and Tribes, ceded 10.8 million acres of their ancestral homeland to the U.S. government in 1855, but reserved the right to hunt and fish, access and use traditional cultural sites, gather traditional foods and medicines, pasture stock, and have water in sufficient quantity and quality in all of their "usual and accustomed places" within that ceded area.

The reservation and surrounding area offer varied sources of food for subsistence including fishing, hunting, and the gathering of wild roots and berries. Tribal members have historically depended on the Columbia River and salmon for their subsistence. Traditional routes for subsistence were and are now the Columbia River, starting above Priest Rapids to the traditional fishing site on Celilo Falls, and extending west on the lower Columbia River beyond the Klickitat River.

***Fisheries***

Currently, as in the past, salmon and steelhead fishing is critical to the way of life for the Yakama Nation. The Tribe places greatest cultural importance on harvesting wild salmon for ceremonial uses, and Tribal management policies prioritize the restoration of natural stocks and habitats. Despite preferences for wild fish, most Tribal fishers recognize that hatchery fish are more abundant in the river and in their harvests. Subsistence fishing is permitted year-round in the mainstem Columbia River unless closed by Tribal regulation to meet management guidelines. Primary gear is hoopnets tied to scaffolds erected on the bank, hook-and-line, and gillnets permitted by the Tribal government in certain circumstances. Subsistence fishing in tributaries within the ceded area (Wind River on the west to the Methow River on the north) is allowed when and where returns are strong enough to meet spawning needs and provide harvestable surplus. Dipnets and hook-and-line are the only authorized gear in tributary fisheries. Gillnets may be used in Zone 6 as authorized by the Tribe to harvest prescribed numbers of fish for ceremonial and subsistence purposes. Commercial fishing is conducted primarily with gillnets, but fish caught with the subsistence gear types described above may be sold during commercial seasons. Tribal harvests typically occur all year and include spring, summer, and fall chinook; coho; sockeye; and summer and winter steelhead. The Yakama Nation harvests fish primarily in Zone 6 of the Columbia River, its tributaries (Yakima and Klickitat rivers), and Icicle Creek, which is a tributary to the Wenatchee; they do not feel that they share any of these tributaries with other Tribes. In general, salmonids are harvested with hook-and-line, gillnets, hoop nets, and dip nets (Parker 1999, JSA Survey).

***Commercial Fisheries***

Commercial salmon and steelhead fishing is important to individual Tribal members' way of life, with some members using it as their main source of livelihood. Although commercial salmon and steelhead fishing is not a main source of livelihood for the majority of members, it does provide a means for continuing with parts of the Tribe's historical lifestyle. Over 500 Tribal members conduct commercial fishing activities for an average of 15 days each year (Parker 1999, JSA Survey).

The Yakama Nation has three commercial seasons: the winter season from February 1 through mid-March for sturgeon, the spring season from mid-May through mid-June for spring chinook and shad, and the fall season from early August through mid-October for fall chinook and steelhead. Tribal commercial fishing is permitted in Zone 6 of the Columbia River except in specific areas where closures are established to protect stocks. The Yakama Nation also occasionally authorizes commercial fisheries in some tributaries and terminal fishing areas such as the Klickitat River and Drano Lake. Landings in the Zone 6 Treaty commercial fisheries crested in 1988 and then decreased through 1995, with the harvest of fall chinook increasing over the past several years to about one-third to one-half of the levels experienced in the late 1980s (Yakama Nation 1998).

Although the winter gillnet season targets white sturgeon, spring chinook are also caught. Fishermen use set gillnets up to 400 feet long, with no restrictions on mesh size. The Treaty commercial sale of spring chinook has averaged 49 fish annually since 1982; however, many of the first spring chinook caught in gillnets are retained for traditional "first salmon" Tribal ceremonies and subsistence uses (Yakama Nation 1998). Upriver

bright chinook are targeted in the Yakama's commercial fishery and significant numbers of steelhead and "tule" chinook are also caught. The practice of releasing wild salmonids caught in commercial harvests varies by individual, but Tribal members are trying to avoid harvesting wild steelhead (Parker 1999).

***Ceremonial and Subsistence Fisheries***

Salmon are an essential part of Tribal ceremonies such as traditional feasts, funerals, and memorial dinners; for subsistence, it is an important part of Tribal members' diets. The ceremonial and subsistence fisheries can occur at any time of the year on the Columbia River and from early April until the end of October on the various tributaries (Yakama Nation 1998, Parker 1999). The Yakama Nation conducts ceremonial and subsistence fisheries on the Yakima, Klickitat, Wind, and Columbia rivers and Icicle Creek; the Yakima and Klickitat rivers are of particular importance to the Tribe. Since 1994 a subsistence fishery has been conducted at Willamette Falls on the Willamette River. Other tributaries that are of interest to the Tribe include the Little White Salmon, White Salmon, Wenatchee, Entiat, Methow, and Okanogan rivers (Yakama Nation 1998).

Ceremonial and subsistence fishing is usually conducted using a long-handled hoopnet that can be fished passively or actively from a platform extending over a river. Although this type of fishing can occur anywhere in Zone 6, the majority of platforms are at the Lone Pine in-lieu site (25 were identified in 1989) at The Dalles, Oregon, and at the Cascade Locks (40 were identified in 1989) just above Bonneville Dam. Approximately 50 platforms were identified in 1989 throughout the remainder of the Bonneville and The Dalles dams pools (Yakama Nation 1998). In recent years, more hook-and-line fishing has occurred and has become popular below John Day and The Dalles dams. If large quantities of fish are needed for a traditional activity, gillnets are permitted under a strict agreement between the Tribes and the states. Ceremonial permit gillnets are used almost exclusively during the spring to harvest spring chinook salmon, the most valued species for traditional and cultural reasons. In 1998 the Yakama Nation harvested approximately 605 spring chinook under 16 spring ceremonial permits (Yakama Nation 1998). The release of wild salmonids from ceremonial and subsistence fishing activities varies by individual. Tribal members' willingness to release wild fish is a function of market and subsistence values. Wild steelhead are the only species routinely released, and they are released only from dipnets when there is little or no commercial interest in them. Steelhead are of lower subsistence value than Pacific salmon, and many Tribal fishers would rather release them than take them home. This is primarily a result of a traditional aversion to wasting resources.

**Confederated Tribes of Warm Springs**

***Current Characteristics***

The Warm Springs Indian Reservation is more than 641,000 acres (more than 1,000 square miles) across arid canyons and mountain forests in parts of Jefferson and Wasco counties, Oregon. The reservation extends from the summit of the Cascade Mountains and 10,497-foot Mt. Jefferson, east to the Deschutes River at a 1,000-foot elevation, and then south the Metolius River and Lake Billy Chinook, where they form the southern boundary. More

than half of the reservation is forested and the remainder is primarily range land. Tribal headquarters is located in Warm Springs (Northwest Portland Area Indian Health Board May 21, 1999; Nat Shaw, Warm Springs Public Information Department, June 24, 1999).

The Tribe has 3,755 members; approximately 3,200 members and 460 non-members live on the reservation. The Confederated Tribes operate many businesses, including Kah-nee-ta Resort, Warm Springs Museum, Indian Head Gaming Center, Warm Springs Power Enterprises (Pelton Re-regulating Dam Hydroelectric Project), Warm Springs Forest Products Industries, Warm Springs Apparel Industries, and the KWSO Radio Station. Annual Tribal employment is approximately 575 people; up to 1,200 members are employed in peak work seasons. An additional 350 people are employed full-time at other Tribal businesses (Northwest Portland Area Indian Health Board [NWPAIHB]; Nat Shaw, Warm Springs Public Information Department June 24, 1999).

***History***

The Confederated Tribes of Warm Springs is comprised of the Walla Walla (later called the Warm Springs), the Wasco, and the Paiute Tribes. These and other Tribal groups developed an extensive economic network that centered on the mid-Columbia River region and depended on the Columbia River and its resources, particularly the salmon (Nat Shaw, Warm Springs Public Information Department June 24, 1999).

The Wasco bands on the Columbia River were the easternmost group of Chinookan-speaking American Indians and remained at their village sites along the Columbia River year-round. Wasco were primarily fishermen and traders, obtaining roots, trade beads, furs, clothing, and horses in exchange for root bread, salmon meal, and bear grass. They fished by building scaffolding over falls in the river and using long-handled dip nets to harvest salmon and other migrating fish. Individual fishing sites were highly prized and were passed along within families for generations. One of the most popular sites, Celilo Falls on the Columbia River, was inundated with the construction and operation of The Dalles Dam in 1958, so Tribal members currently fish over falls located on the Deschutes River (Nat Shaw, Warm Springs Public Information Department June 24, 1999).

Wasco's closest up-river neighbors were the Warm Springs bands who lived along Columbia River tributaries and traveled between winter and summer villages. Warm Springs depended more on game, roots, and berries than Wasco, but salmon was also an important staple (Nat Shaw, Warm Springs Public Information Department June 24, 1999).

Paiutes lived in southeastern Oregon and fish were not as important for them as for the Tribes residing closer to the Columbia River. They moved often over a wide area to harvest plants and game, and interacted infrequently with the other Tribes (Nat Shaw, Warm Springs Public Information Department June 24, 1999).

The Wasco and Warm Springs Tribes signed a series of treaties in 1855. One of these treaties created the Warm Springs Reservation and reduced the Tribal lands by approximately 10 million acres (14,000 square miles) for the exclusive use of the Tribe. The Tribes retained their rights to harvest fish, game, and other foods from the reservation and, approximately 24 years later, the Paiute Tribe moved to the reservation. In 1937 the three Tribes organized as the Confederated Tribes of the Warm Springs Reservation and in

1938 accepted a corporate charter to conduct business ventures (Nat Shaw, Warm Springs Public Information Department June 24, 1999).

***Fisheries***

Currently, as in the past, salmon and steelhead fishing is extremely important to the way of life for the Confederated Tribes of Warm Springs. Because of reduced salmonid stocks, Tribal members consider the harvest of wild salmon, a preference for their Tribe, a luxury (Fagen 1999). Tribal harvests typically occur from March through October and include spring, summer, and fall chinook; sockeye; and steelhead. Tribal members fish primarily in Zone 6 of the Columbia River, the Deschutes River, and the Willamette River, with some additional harvests in the Hood and John Day rivers (Fagen 1999). Rivers and their tributaries are not fished exclusively by any one Tribe. Warm Springs Tribal members share the Columbia River with Yakama Nation, Confederated Tribes of Umatilla, and Nez Perce Tribe, and share the John Day River with Confederated Tribes of Umatilla (Fagen 1999).

***Commercial Fisheries***

Approximately 15 Tribal members conduct commercial fishing activities for 4 to 6 weeks each year, usually in September and October, for fall chinook. Tribal members typically conduct commercial fish harvests with gillnets in Zone 6 of the Columbia River.

***Ceremonial and Subsistence Fisheries***

Several hundred Tribal members conduct ceremonial and subsistence harvests in the Columbia and Deschutes rivers using hook-and-line, gillnets, dip nets, and set nets. Tribal members conduct ceremonial and subsistence fishing activities regularly over a 6-month period and intensively for 4 to 6 weeks within that period. Wild steelhead harvested during subsistence fishing on the Deschutes River are released (Fagen 1999).

**Confederated Tribes of Umatilla**

***Current Characteristics***

The Umatilla Indian Reservation is approximately 172,000 acres and comprises approximately 8 percent of Umatilla County, Oregon (NWPAIHB, Confederated Tribes of the Umatilla 1996). There are approximately 1,900 Tribal members. There is no Tribal-sponsored housing available but housing is available in the city of Pendleton, approximately 5 miles away. Approximately two-thirds of the Tribal members live on or near the reservation with approximately 1,000 American Indians from other Tribes and 1,700 non-American Indians (NWPAIHB; Confederated Tribes of the Umatilla 1996).

The Tribe has a number of offices and programs, including a Department of Natural Resources and a Department of Fisheries, that employ approximately 360 people. The Tribe also owns a grain elevator, store, trailer court, gaming resort, and hotel. To be completed in 1998 was a cultural institute, RV park, 18-hole golf course, entertainment park, and a convenience store/gas station (NWPAIHB, Confederated Tribes of the Umatilla 1996).

***History***

Confederated Tribes of the Umatilla Indian Reservation are descendants of the Cayuse, Umatilla, and Walla Walla Indian Tribes. Their original lands covered 6.4 million acres in southeastern Washington and northeastern Oregon. Umatilla and Walla Walla Tribes frequented the Columbia River and the lower regions of its tributaries—the Umatilla River and Willow Creek for the Umatilla Tribe and the Walla Walla and Snake rivers for the Walla Walla Tribe. The Cayuse Tribe lived on the upper courses of the rivers draining into the Columbia River, including the Grande Ronde River and upper sections of the Tucannon and Touchet rivers. All three Tribes hunted east of the Blue Mountains. Bands camped at their favorite locations during the year but all shared the same area. Most bands gathered at winter sites on or near the Columbia River, with winter camps located at such present-day areas as Mission and Umatilla, Oregon, and Walla Walla and Pasco, Washington (Confederated Tribes of the Umatilla Indian Reservation 1996).

The life and culture of the Tribes centered on the gathering of food throughout the seasonal cycles of migration over their lands. The principal food sources were salmon and roots but they also collected and ate berries, deer, and elk. The Tribes fished for salmon in the Columbia River and its tributaries from late spring to fall, but Tribal members also harvested eel, steelhead, sturgeon, suckers, whitefish, and other fish. Fish were harvested with hook-and-line, nets, spears, and traps. As with the Warm Springs Tribes, Umatillas suspended wood platforms from bluffs and large rocks along the Columbia River and other major fishing rivers such as the Palouse, Snake, Yakima, Walla Walla, Umatilla, Grand Ronde, and John Day rivers. Fish were not only used as a major food source for the Tribe but were also exchanged with Tribes from as far away as the Great Plains for trade goods and buffalo meat (Confederated Tribes of the Umatilla Indian Reservation 1996).

The Walla Walla Treaty of 1855 was negotiated with the three Tribes and established the confederation. This treaty established the Umatilla Indian Reservation, on traditional Cayuse territory, and the Tribes became known as Confederated Tribes of the Umatilla Indian Reservation. Disruptions of their annual food-gathering cycle and depleted livestock herds forced a majority of the Tribal members to move onto the reservation by 1860 to obtain food and clothing from the federal government (NWPAIHB; Confederated Tribes of the Umatilla Indian Reservation 1996).

In 1885 the Slater Act was passed, which created an allotment system to provide each enrolled Tribal member individual tracts of land from the reservation. These individual tracts could then be sold by each Tribal member to anyone, including non-American Indians. Such sales resulted in the checkerboard pattern of American Indian and non-American Indian lands now present on the reservation. The Tribal culture was further weakened by the construction of dams and flooding of traditional fishing sites, as described previously under Confederated Tribes of Warm Springs (Confederated Tribes of the Umatilla Indian Reservation 1996).

***Fisheries***

Currently, as in the past, salmon and steelhead fishing is critical to the way of life for Confederated Tribes of the Umatilla Indian Reservation and remains the foundation of the Tribe's culture and religion. Unlike other Tribes, it appears that Tribal members of Confederated Tribes of Umatilla are more concerned about using traditional locations and gear to harvest fish, rather than whether those fish are of native or hatchery stock (James

1999). The Tribe typically harvests spring, summer, and fall chinook; coho; sockeye; and steelhead. Species harvested at various times of the year typically include steelhead and sturgeon (February and March), steelhead and chinook (April), chinook (May through July), Columbia River commercial fishing (August), Columbia River commercial fishing and coho (September), steelhead and coho (October and November), and steelhead (December and January) (James 1999).

The Tribal members fish in the Columbia River and tributaries located in southeastern Washington and northeastern Oregon. Steelhead, spring chinook, fall chinook, and fall coho are harvested in the Umatilla River; steelhead and spring chinook are harvested in the John Day River; and steelhead are also harvested in the Grande Ronde and Tucannon rivers (James 1999). Rivers and their tributaries are not fished exclusively by any one Tribe. Umatilla Tribal members share the Grande Ronde and Tucannon rivers with the Nez Perce Tribe, the John Day River with Confederated Tribes of Warm Springs, and the lower Yakima River with the Yakama Nation (James 1999).

#### *Commercial Fisheries*

Approximately 30 Tribal members conduct commercial fishing activities for about 60 days each year. Tribal members typically conduct commercial fishing in Zone 6 of the Columbia River, harvesting chinook in the fall and steelhead and sturgeon in the winter. Commercial fishing in Zone 6 of the Columbia River is usually conducted using hook-and-line, gillnets, and dip nets; Tribal commercial fishermen usually keep both wild and hatchery fish (James 1999).

#### *Ceremonial and Subsistence Fisheries*

As many as 100 Tribal members participate in ceremonial and subsistence fisheries, typically for spring chinook in the Columbia River. Ceremonial and subsistence harvests are conducted using gillnets for about 60 days annually in Zone 6 of the Columbia River, platform dip netting about 60 days in Zone 6, and hook-and-line, and are conducted in the tributaries for 1 to 3 weeks. Wild steelhead are typically released on a voluntary basis, mostly by Tribal members using hook-and-line (James 1999).

### Shoshone-Bannock Tribe

#### *Current Characteristics*

The Fort Hall Indian Reservation, where the Shoshone-Bannock Tribe is located, includes approximately 544,000 acres adjacent to Interstates 86 and 15 in southeastern Idaho. The reservation lies partially in Bingham, Bannock, Power, and Caribou counties. Tribal headquarters is located east of Fort Hall. There are 3,951 Tribal members. The Tribe has a number of offices and programs that employ approximately 227 full-time and 25 part-time workers in fish and wildlife related positions, retail outlets, a gaming facility, museum, and newspaper (NWPAIHB, Shoshone Bannock Tribal Enterprises 1999).

### *History*

The territory of the Shoshone and Bannock Tribes originally included large areas of the states of Idaho, Utah, Wyoming, and Nevada, particularly the Salmon and Snake River area in what is now southern Idaho. The Tribes traveled throughout this region to hunt, gather food, and fish for salmon (Shoshone Bannock Tribal Enterprises 1999).

The reservation was established with the Treaty of July 2, 1863, at Fort Bridger, Utah. On July 14, 1867, an Executive Order set aside the reservation for the Boise and Bruneau Bands of the Shoshone and Bannock Indian Tribes. The original 1.8 million acres was reduced to approximately 1.3 million acres in 1869 and a surveying error in 1872 further reduced the reservation to 1.2 million acres. The Treaty of July 30, 1883, then defined the reservation as the land bordered on the east by the Portneuf Mountains and bordered on the west by the Raft River. Additional land was ceded to the U.S. government in 1900, leaving the existing 544,000-acre reservation (NWPAIHB, Shoshone Bannock Tribal Enterprises 1999).

### *Fisheries*

A representative of the Shoshone-Bannock Tribe was contacted to learn more about the importance of salmonid fisheries for the Tribe but they did not wish to provide information.

## Nez Perce Tribe

### *Current Characteristics*

The Nez Perce Indian Reservation includes approximately 138,000 acres, of which about 34.8 percent is Tribally owned and is located along U.S. Highway 12 east of Lewiston, Idaho, in Nez Perce, Lewis, Clearwater, and Idaho counties. Tribal headquarters is located in Lapwai, Idaho (NWPAIHB, University of Idaho 1996). The Tribe has approximately 3,250 Tribal members and has several businesses employing approximately 700 people in forest products, mining, retailing, gaming, and service businesses.

### *History*

At one time, the Nez Perce occupied a 17-million acre territory covering north central Idaho, northeastern Oregon, and southeastern Washington. The Tribe traveled seasonally, hunting buffalo on the Great Plains, fishing for salmon at Celilo Falls on the Columbia River, and trading with Tribes located in British Columbia, on the Pacific Coast, and in the Mississippi River Valley (University of Idaho 1996).

The 1855 Treaty reserved most of the Tribe's ancestral homelands; however, the discovery of gold in the 1860s led to the creation of the Treaty Council of 1863, which reduced the reservation by 7 million acres and reduced the Nez Perce Indian Reservation to approximately 757,000 acres. The Dawes General Allotment Act of 1887 allocated lands to individual members of the Tribe. In 1893 the Tribe signed an agreement that allowed unallocated lands to be declared a "surplus" and sold to the U.S. government for homesteading. The Dawes Act and the related agreement resulted in the reservation being reduced to approximately 138,000 acres (NWPAIHB; University of Idaho 1996).

***Fisheries***

The Nez Perce Tribe participates in commercial, ceremonial, and subsistence fisheries in Zone 6, as well as in fisheries in much of the Snake River Basin. Fisheries in the Snake River and its tributaries are typically ceremonial and/or subsistence, but the tribe may authorize commercial fisheries, usually targeting abundant returning hatchery fish.